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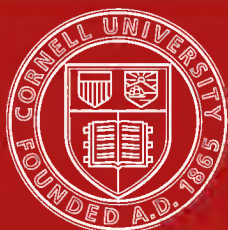
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DEPARTMENT OF AGRICULTURE.

CONTAGIOUS DISEASES

OF

DOMESTICATED ANIMALS.

INVESTIGATIONS

BY

DEPARTMENT OF AGRICULTURE,

1883-1884.

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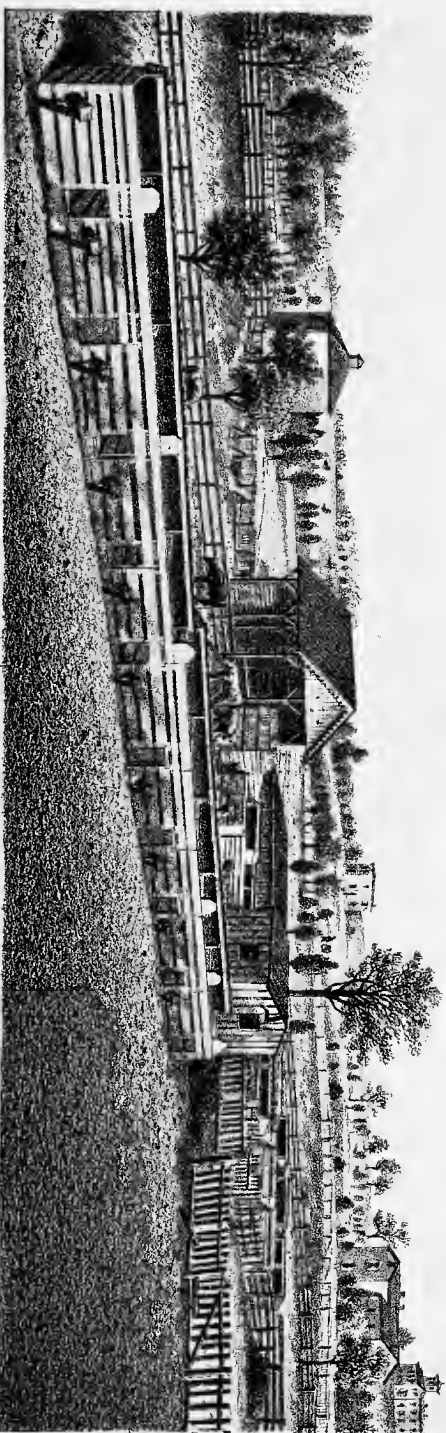
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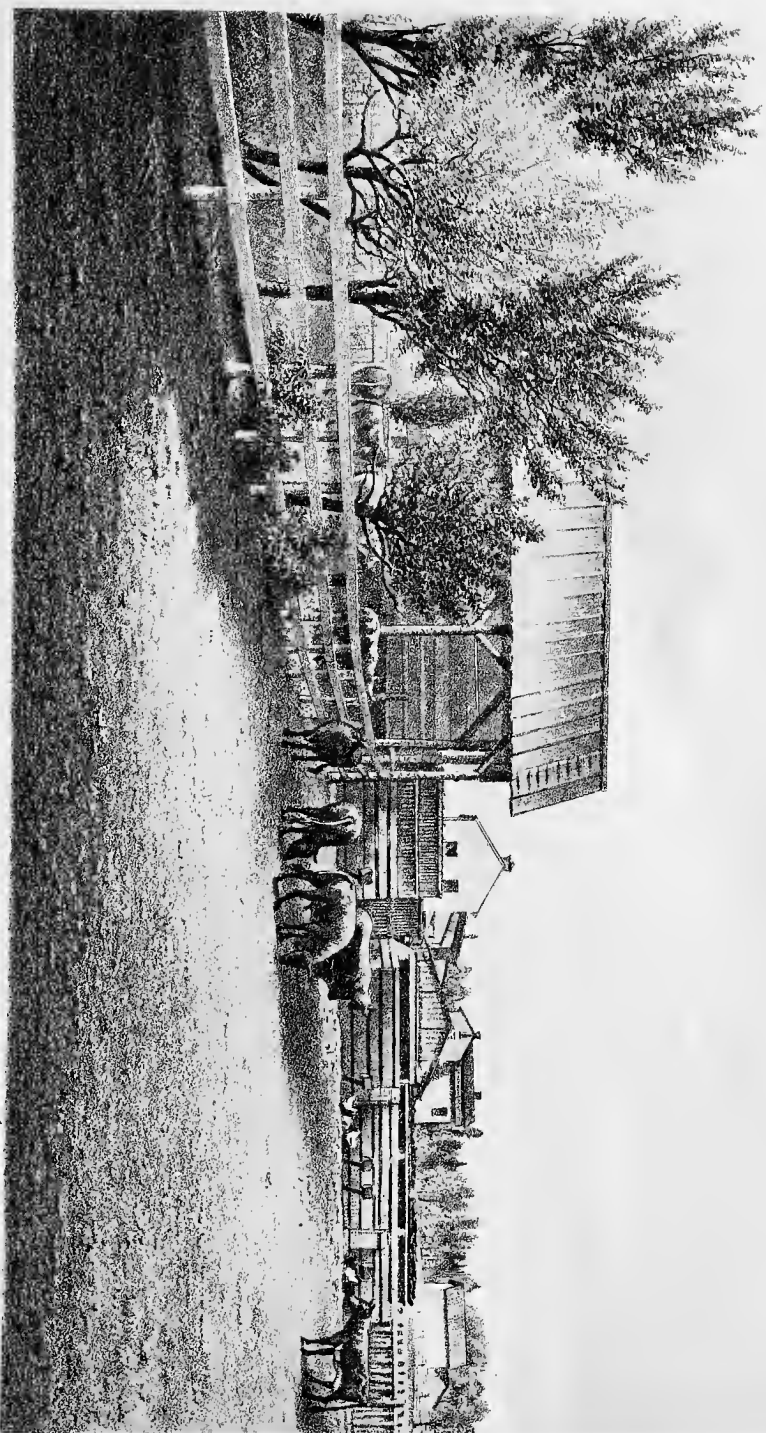
VETERINARY EXPERIMENTAL STATION, DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.

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W. L. Lull, M. D.
Veterinarian,

1523 Race St. Phila.
RESULTS OF INVESTIGATIONS MADE DURING THE
YEAR 1883-'84.

Hon. GEO. B. LORING,
Commissioner of Agriculture:

SIR: In my last report brief mention was made of the Veterinary Experimental Station established by your direction near this city. Since then many additions have been made to this Station, and it is now thought a more detailed description will prove of interest to those engaged in investigations as to the cause, transmission, and prevention of infectious and contagious diseases incident to domestic animals both in this and in other countries.

The Station is located on the Benning's Bridge road, about one-fourth of a mile east of the northeastern boundary of the city. The plat of ground on which it is located consists of 7 acres of rolling land, which is subdivided by new fencing into three pasture fields. The largest inclosure contains 4 acres, the second 2 acres, and the third 1 acre. There are seven outbuildings for the accommodation of cattle and the protection of the necessary implements for keeping the place in proper condition. Two wooden and two brick structures are used for the accommodation of cattle alone. The interior of the stables are fitted up with box stalls located on each side of a 4-foot passage-way extending the entire length of the buildings. The average measurement of each stall is 8 by 10 feet. One stable contains eight stalls, a second five, and a third four. When necessary, two steers or cows can occupy each stall with comfort. Ample feed-rooms are attached to each stable.

The fourth building is a wooden structure 25 feet wide by 31 feet in length, with interior free of compartments. This building is used for the protection from inclement weather of the cattle, which are allowed to graze on the largest pasture field, and has been left open on the south side.

Four rows of pig-pens are located at different points on the premises. One of these pens is 60 feet in length by 10 feet in width, and is subdivided into ten compartments. Two others are 30 feet in length, and contain five pens each. The fourth is divided into four pens. Ten or twelve pigs can be accommodated with comfort in each pen. They are supplied with cast-iron water-troughs, and the floors of each, as well as those of the stables, are laid in concrete, which prevents the absorption of water and facilitates disinfection.

In addition to the pens and stables a large chicken-house, 25 feet in length by 12 feet in width, has been provided for experiments with contagious diseases incident to fowls. A small building, midway between the pens and stables, has been fitted up for *post-mortem* examinations, and is supplied with all the necessary instruments for making autopsies.

A brick dwelling house, about 40 feet square and two stories in height, is located near the northern extremity of the grounds, and is occupied by W. H. Rose, V. S., superintendent of the Station. The water for the Station is supplied by two excellent wells conveniently located. Plates I, II, and III, accompanying this report, give accurate views of the buildings and grounds from different points.

INVESTIGATIONS OF PLEURO-PNEUMONIA.

DISTRICT OF COLUMBIA.

No systematic inspection of cattle has yet been made in the District of Columbia, but we have secured a number of sick cows which have been slaughtered and examined in order to determine the nature of the disease from which they were suffering. Other cases have been brought to our attention by Dr. Townshend, the able health officer of the District, in regard to which we have made all the investigations that were possible. During the year we have in this way found the disease in ten stables in which more than one cow was kept, and in three others in which the diseased animal was the only one owned. In one stable two have died; in a second, one had died and two were sick; in a third, five had died and six were more or less affected; in a fourth, two had been lost; in a fifth, six had been lost; in a sixth, five had died; in a seventh, three had died; and in the remaining three stables the loss, so far as we are aware, has been one animal each.

The total number of animals referred to above is twenty-seven which have died, and eight which were sick at inspection. In these cases the symptoms and *post-mortem* appearances of the animals examined were those of contagious pleuro-pneumonia, and the history, when it could be obtained, also pointed in this direction. The following instance is an illustration of this:

A cow belonging to Mrs. Flanigan, of Benning's road, was discovered sick, May 22, 1883. The symptoms were a severe, dry cough emaciation, arched back, extended head, and turning out of the elbows. Percussion and auscultation showed that there was dullness and loss of respiratory murmur over the right lung.

This animal was preserved until August 27, and then slaughtered. The anterior portion of the right lung was found to contain a large encysted mass of hepatized lung tissue, fully 5 inches in diameter, which was beginning to disintegrate and break down into pus. The

left lung was affected with chronic bronchitis, and many of the bronchi were filled with a thick, white, tenacious pus.

The disease was brought to this stable in the latter part of December, 1882, by a cow dealer who lives near the navy-yard. She presented symptoms of disease in about two weeks after purchase and lingered for six weeks with symptoms of acute lung disease. Three weeks after the death of this first cow a second became sick, with similar symptoms, and died after four weeks' illness.

Two others were successively affected in a similar manner and died; and, finally, the fifth came down with the disease about the 1st of May, 1883.

On May 29, 1883, we received at the Veterinary Experiment Station a cow from the stable of Catharine Bresnahan, of Lincoln avenue. This animal was somewhat tympanitic and stood with arched back, elbows turned out, and extended head. With each expiration there was a loud moan. Examination over the lungs revealed dullness, tenderness, and loss of respiration on the right side.

This animal died during the night of June 3, and was examined the following day. The right lung was found to be firmly attached to the ribs and diaphragm over nearly the whole surface of contact. This lung was almost completely hepatized; the posterior part was gangrenous; the median portion showed old hepatization, in which there was little difference in color between the lobular and the interlobular tissue, while the anterior portion was freshly hepatized and presented the distinctly marbled appearance seen in acute pleuro-pneumonia, and thought by some to be characteristic of that disease. The condition of this lung showed beyond question that the inflammation was a progressive one, and, beginning in the posterior portion of the organ, had successively invaded the median and anterior portions.

The existence of inflammation of different ages, showing the progressive character of the disease, is now regarded by the leading authorities of Europe as the most satisfactory means of distinguishing between contagious pleuro-pneumonia and the sporadic inflammations of the respiratory organs. The pleural cavity contained about a quart of effusion, and the mucous membrane of the bronchial tubes was of a deep red color.

This animal presented, consequently, all the symptoms and *post-mortem* appearances described as peculiar to pleuro-pneumonia. The only history that could be obtained was that a number of cows had previously been affected in this stable with similar symptoms.

September 18, 1883, I examined a cow on Nineteenth street, which had rapid and difficult breathing, with extended head and elbows turned out as in cases of pleuro-pneumonia. There was dullness over the lower half of both lungs, with resonance above, but no respiratory murmur could be detected over the left side from the shoulder backward. This animal died on the morning of September 21, and on examination the left

lung was found solidly attached to the ribs and diaphragm. There was an abundant effusion of liquid into the pleural cavity; the pericardium was greatly distended and attached to the costal pleura. On section the lung was found free from hepatization, but the pericardium was greatly thickened and transformed into a fibrous cyst inclosing the heart. The surface of the heart showed that this organ had been intensely inflamed; it was roughened and covered with granulations, mostly gray in color, but over parts of the surface mottled with deep red. The heart tissue, to a depth of half an inch from the surface, had undergone fibrous degeneration, was colorless, and resisted the knife. A painting was made of this organ and is reproduced in this report as Plate IV; it shows very plainly the thickened pericardium, the mottled appearance of the surface of the heart, which organ was cut across to reveal the depth of the fibrous degeneration.

There may be a question as to the exact nature of this disease—whether it was induced by the virus of lung plague or whether by other causes. No diseased animals had been introduced on the place, but there had been opportunity of exposure to animals running at large. The absence of hepatization is not conclusive evidence that it was not lung plague. This disease quite often confines itself to the serous membranes without appreciably affecting the lung tissue, and pericarditis and epicarditis are manifestations which have been described as occurring in the infected stables of Europe. I am inclined to think, therefore, that this affection was the result of exposure to the lung-plague virus.

January 12, 1884, three cows were slaughtered at the Veterinary Experiment Station in presence of Hon. James Wilson, of Iowa, member of the House Committee on Agriculture, and of delegates from the Chicago convention of stockmen and of distinguished veterinarians, in order to demonstrate the character of the disease from which the cattle in this vicinity were suffering. The first one was a young cow that I found January 1, 1884, at the stable of the owner near Washington. At that time her breathing was rapid and labored, a distinct grunt or moan being emitted at each expiration. On percussion over the region occupied by the lungs the right side was found perfectly dull and without resonance, while the left side was resonant over the upper half, but very dull below. Auscultation showed complete loss of respiratory murmur over the whole of the right and over the lower part of the left side. There was no cough.

This cow had been purchased about a month previously, from a dealer who had brought her from the Shenandoah Valley, in Virginia, and had kept her for a number of days (the exact time not known) at his stable in Washington. She was noticed to isolate herself from the remainder of the herd while at pasture, and to be disinclined to move, almost as soon as she was placed with the herd. She commenced moaning at each expiration more than two weeks before I saw her, and was then separated from the other animals. January 2 she was removed to the Experiment Station, her temperature at that time being about 103° F.



Marx from Nature.

A. Heen & Co. Lithocautic, Baltimore.

This cow died during the night of January 11, and was examined about 11 o'clock the following day. On opening the thorax about 2 gallons of amber-colored liquid escaped. The right lung was solidly attached to the costal pleura and diaphragm by thick false membranes of recent formation. On the left side the attachments were not so extensive, and the membranes were of still more recent growth. On each side there were thick masses of coagulated lymph, weighing from 2 to 3 pounds, and of a whitish color and firm consistency, which indicated their formation a number of days before the death of the animal. The lung tissue presented no signs of hepatization.

The second cow examined was brought to the Station over two months before, and at the time of this examination was somewhat emaciated. She was coughing when first seen, had little appetite, and an examination of the lungs showed dullness and loss of respiratory murmur over the lower part of the right lung.

Three animals had previously been lost in the stable from which she came, and before death they presented symptoms of lung disease.

This cow was slaughtered, and on opening the cavity of the thorax the left lung was found adherent to the diaphragm and the right lung to the costal pleura. The right lung contained four or five masses, varying from two to four inches in diameter, surrounded by a thin cyst wall and composed of hepatized lung tissue in a disintegrating condition.

The third animal, which was also somewhat emaciated, was obtained January 10, from a stable where two cows had been lost in the preceding summer. She had been purchased for \$50 two or three months before she sickened, and was at that time in good health. When brought to the station her temperature was 104° F., and there was complete dullness and loss of respiration over the left lung. Her condition was substantially the same on the day of examination, January 12. When, after slaughter, the ribs of the left side were removed, a considerable quantity of amber-colored liquid escaped. This lung was completely hepatized and solidly attached to both the ribs and diaphragm. A section of the lung disclosed the interlobular tissue distended with lymph, though not to the degree sometimes seen. There was, however, a very distinct marbled appearance, and a difference of coloration between the upper and lower parts of the lung that probably resulted from a difference in the age of the hepatization in these two portions. The right lung of this animal was in a normal condition.

A fourth cow was obtained from a Washington stable the same day that the above examinations were made. She died during the night of January 12. Her appearance before death and the condition of her lungs when examined were very similar to that of the third cow mentioned above.

May 1, 1884, a sick cow was reported at Miss Fannin's, on M street,

in this city. She was examined the same day and found to be moaning with each expiration; her breathing was labored; there was salivation, extended head, and elbows turned out. The bronchial breathing was loudest on the right side; the left side was very dull on percussion up to and somewhat above the median line. The right side had a dull area at lower portion of thorax and another above the median line.

May 5, this animal, now sinking rapidly and already tympanitic, was slaughtered. The autopsy revealed the left lung completely solidified with the exception of a very small part of the anterior lobe. Various stages of inflammation were to be seen in the different parts of the lung. There were thick false membranes and solid adhesions to the diaphragm and costal pleura. The right lung was extremely emphysematous, and parts of it adherent to the costal pleura, but there was no hepatization of its tissues.

CONNECTICUT.

In the latter part of August, 1883, I investigated an outbreak of disease at Salem, Conn., which had affected cattle on the farms of H. E. Williams and Captain Seaman, of that place. The history of this outbreak may be summarized as follows: Hon. E. H. Hyde, of the State Commission on Diseases of Domestic Animals, first visited the farm of Mr. Williams on August 8, and at that time found a young bull in the lot partially recovered from an attack of disease, and a cow and an ox were both very sick with what he considered to be the typical symptoms of pleuro-pneumonia. At Captain Seaman's a cow was very sick and presented the same symptoms as were seen with the affected cattle belonging to Williams.

The next morning Dr. Rice, of Hartford, was called, and on arrival, Williams' cow was found to have died during the night.

A *post-mortem* examination was made and the lung found attached to the walls of the chest; when cut across it was seen to be solidly hepatized, of a marbled appearance, and presented all the characters of contagious pleuro-pneumonia. The Commission advised slaughter, which was objected to, but the same day after the departure of the State officers, the sick ox belonging to Williams and the cow belonging to Seaman were slaughtered. These animals were not examined professionally, but the descriptions which I received from those who were present were sufficient to satisfy me that the lungs were solidified and attached to the ribs.

August 29, I visited Mr. Williams' farm and learned from him the particulars of the outbreak. The first symptoms of disease were seen in one of the cows June 20, and a second cow was attacked on June 23; both of these died from the effects of the disease July 3. At the time of my visit, August 29, there were six animals on the place: one ox, quite sick with left lung solidified; one Jersey cow, had been quite sick but was now better; one young Jersey bull, with left lung solidi-

fied, and three Jersey cows, in which I found no evidence of disease. Only one animal had been brought on the place within a year preceding the outbreak, and that was a Jersey cow named Mollie Lathrop 3rd, No. 7627. She was obtained by exchange with Charles Decline, of New Durham, N. J., on April 10, 1883. This cow aborted the last of May, but has shown no other signs of sickness. At the time of examination she was in fine condition, fat, glossy, with no cough and no signs of lung disease, revealed by either auscultation or percussion.

I visited Charles Decline at New Durham, N. J., on August 30. He stated to me that he exchanged cows with Williams about April 16. His cow went to New London on the same boat that the other returned by. According to the statement of Williams' farmer, the two cows were together about a quarter of an hour at New London. The cow Decline received from Williams sickened about the last of May. About a week later, she and another Jersey cow which stood beside her, and which was also sick, were killed and examined by his son, who is a veterinary surgeon. Both were affected with lung disease which he pronounced to be pleuro-pneumonia. The lungs were hepatized, marbled in color, and attached to the walls of the chest.

Decline purchased Mollie 3d of Mr. Whitenack, of Dunellen, N. J., December 13, 1881. He says that he never had any disease among his cattle until after the cow arrived from Connecticut, and attributes the infection to her.

It was evident that some of the facts connected with the history of the disease in these two herds had been concealed, but it was very certain that the disease had existed in both herds, and it was very probable that one of the herds had been infected as the result of the exchange referred to above. Considering that there had been no disease in Connecticut until nine weeks after the exchange, and that it was admitted to have existed in Declines' herd four weeks earlier than it appeared among Williams's cattle; and considering, further, that the vicinity of New Durham has long been infected with pleuro-pneumonia while none had previously existed in the neighborhood of Salem, and the probability is that the disease was carried from New Jersey to Connecticut. There is one other possibility, however, viz., that both cows were infected on the boat or between the boat landing and Decline's place.

This theory is not probable, for the reason that a second cow was sick at Decline's by the last of May, and this would require the assumption that two full periods of incubation had elapsed between April 16 and May 30; that is, within six weeks. Now, it is very seldom that the period of incubation of pleuro-pneumonia is less than four weeks, and it is generally longer than this; consequently, it is very unlikely that in two successive cases on the same farm it would be reduced to three weeks. The admitted fact that both sickened at about the same time is an indication that both were infected at the same time, and from a

common source, rather than that one contracted the disease from the other.

A second visit was made to the farm September 7, in company with Hon. E. H. Hyde and T. S. Gold, of the State Commission on Diseases of Animals, and Doctors Thayer, Rice, and Parkinson. At this time the bull and ox still presented symptoms of pleuro-pneumonia. The cow, Mollie 3rd, was again carefully examined and showed a rather large area of dullness over the region of the heart and another low down on the right side. My own opinion was that this dullness did not indicate any disease of the lungs, though some of the others thought differently. It was admitted by all, however, that there were no positive signs of diseased lungs in her case.

A third visit was made, in company with the same gentlemen, with the exception of Dr. Thayer, September 12, when the ox mentioned above was slaughtered and examined. This animal was now believed by the owner to have recovered. The autopsy revealed the left lung solidly attached over a large surface to the thoracic wall and diaphragm. One-third of the organ was encysted and beginning to disintegrate, another third showed more recent hepatization and was not yet encysted. A section showed the characteristic marbled appearance, and the difference in the age of the inflammatory process in various parts of the lung.

Members of the State Commission have since informed me that the bull continued to fail and was destroyed by the owner on the 27th of October. Before this, however, the Commission was called September 18 to see a new case of the disease, which had developed on the farm of Amos Williams, the second neighbor south from the originally infected premises. This was a cow, which presented the typical symptoms and *post mortem* appearances of pleuro-pneumonia, having been condemned and killed by the Commission.

To recapitulate: H. E. Williams had seven animals affected out of his herd of nine by the introduction of the cow from New Jersey, which animal was so slightly diseased as never to attract attention. Of the seven sick ones three died of the disease. Two of those slaughtered probably could not have recovered; one of the slaughtered oxen was improving, while the remaining cow was very sick when I last saw her. The adjoining farm on the north and the second one on the south each lost one animal from the disease. There were, consequently, nine animals affected in this outbreak.

PENNSYLVANIA.

October 3 and 4 I visited Chester County, Pennsylvania, in company with Mr. T. J. Edge, special agent of the governor, and Dr. Bridge, State Veterinarian. On the farm of W. P. Thomas I witnessed the slaughter of 3 cows, and on the farm of J. H. Garret I saw 5 others killed, these having been condemned by the State authorities as affected with

contagious pleuro-pneumonia. The autopsies revealed the existence of a very similar condition in each of the animals. In most cases a whole lung was hepatized and firmly attached to the diaphragm and ribs. In several of the animals both lungs were affected. The pleural cavity contained large quantities of straw-colored effusion, and the connective tissue of the lungs was excessively distended with exudation of a similar liquid. The inflammation was very plainly of a progressive character, and the marbling of the lung was as distinct as in any cases I have ever seen.

The disease was introduced into this section by a car-load of 14 cows brought by John Noble from Baltimore. Where these cows were originally infected is a contested point between the authorities of Pennsylvania and those of Maryland; but there is no reason to doubt that the outbreak near West Chester was caused by this lot of animals.

These cows were sold as follows: July 19, to W. H. Shepherd, 1; July 26, to W. P. Thomas, 3; July 26, to H. Euches, 4; July 27, to J. H. Garret, 2; August 1, to J. Kelly, 2; not traced at time of report, 2.

Mr. Shepherd's cow was found sick with symptoms of pleuro-pneumonia September 8, and slaughtered by the State authorities. The autopsy revealed the characteristic lesions of lung plague. September 13 a cow was found affected with the same disease and slaughtered on Mr. Garret's farm. September 29 it was necessary to slaughter one of Mr. Thomas' cows. October 1 it was found that two cows had already died on Mr. Euches' farm, and that six others were sick.

According to information received from Dr. Bridge, October 23, 1884, the number of cattle exposed and slaughtered on account of sickness was as follows:

Owner.	Number exposed.	Number killed.
W. P. Thomas	42	42
Homer Euches	29	12
J. H. Garret	33	14
W. H. Shepherd	1	1
Total	105	69

Eight adjoining herds were infected by the above, as follows:

Owner.	Number exposed.	Number killed.
W. H. Pratt	17	6
M. S. Garrett	11	3
E. J. Lewis	15	5
C. Smedley	22	2
Geo. P. Hughes	20	8
W. F. Dutton	16	16
W. Evans	5	1
L. V. and W. E. Smedley	21	9
Total	127	50

The affected cows which I saw were native animals in good condition. They had excellent pastures to run on, and there was no local cause whatever which could be suspected of producing this or any other disease. Besides, the time of year was not one in which acute lung diseases are seen among cattle. Nearly every one of the affected lungs which I saw when in this State showed the typical lesions of pleuro-pneumonia so plainly that, according to the best authorities in the veterinary profession the world over, any one of them would have been sufficient to afford a safe basis for diagnosing the disease.

Besides the herds infected by the contagion introduced with the lot of cattle from Baltimore, six herds have been infected from other sources since September, 1883. The following table shows the number exposed in each of these and the number destroyed after showing symptoms of the disease:

Owner.	Number exposed.	Number killed.
F. Carr	3	1
W. Williamson	5	2
F. Galloy	20	14
— Heisey	9	5
— Myers	17	2
J. Noble	10	0
Total	64	24
Total in preceding tables	232	119
Total for State of Pennsylvania	296	143

NEW JERSEY.

Dr. Rowland, an Inspector of this Department, stationed at Jersey City, N. J., discovered during the summer of 1883 that animals affected with pleuro-pneumonia were being shipped to New York from Hunterdon County, New Jersey. An investigation was ordered by Dr. E. M. Hunt, secretary of the New Jersey State board of health, and a number of herds were found in Hunterdon County which had been for some time affected with this disease. Owing to the fact that the owner of the affected herds was a large cattle dealer who gathered up cheap animals from various parts of New Jersey and Pennsylvania, and to the additional fact that the disease had been upon his premises for an indefinite time, the origin of the trouble could not be satisfactorily traced.

The owners of the infected herds had resorted to inoculation to arrest the progress of the disease, and it was said that all fresh animals which arrived were speedily inoculated. In spite of this, however, the losses were very heavy, though their full extent could not be ascertained. Dr. Miller, who investigated the condition of these animals, November 1, informed me that out of one herd, containing 60 head, 22 had been lost; from another containing 65 head, 8 were known to have died, and 1 was killed to obtain virus for inoculation; from another, containing 46 head, 8 had died; from a fourth, containing 70 head, 10 had died; and from

a fifth, 6 had died. There had, consequently, been at least 55 deaths; in addition, a certain number had partially recovered, and some diseased animals had been sold.

According to the best information we could obtain the total number of cases of pleuro-pneumonia which had occurred in this county was not less than 100. These herds were quarantined and the State authorities are doing everything possible with their limited appropriation to stamp out the disease; but where so many animals have been exposed, and where the contagion has been sown broadcast over the pastures of half a dozen farms, experience shows that it is next to impossible to remove all danger except by killing all animals exposed and quarantining the farms for a long time.

MARYLAND.

Owing to the variety of reports in regard to the existence of pleuro-pneumonia in Maryland, Dr. Rose was directed to proceed to Baltimore during the last week of October, 1883, and examine a sufficient number of stables to form a basis for conclusions in regard to the distribution of the disease in that section. The cases of sickness mentioned are only those in which the symptoms indicated pleuro-pneumonia. The following is a list of stables in the order in which they were examined, with a condensed summary of the information obtained:

- Stable No. 1: Contains thirty-five cows. One chronic case, two recent deaths.
- Stable No. 2: Thirteen cows. No disease.
- Stable No. 3: Sixteen cows. One chronic case, two recent deaths.
- Stable No. 4: Seven cows. No information.
- Stable No. 5: Nineteen cows. Admit that cows are exchanged as soon as they show signs of disease.
- Stable No. 6: Nine cows. Three recent deaths.
- Stable No. 7: Two cows. Admits recent deaths from lung disease.
- Stable No. 8: Thirteen cows. Two recent deaths from acute lung disease.
- Stable No. 9: Seventeen cows. Have lost many in the past. All are now well.
- Stable No. 10: Eighteen cows. Have lost two during the summer.
- Stable No. 11: Nineteen cows. Would neither allow an examination nor give information.
- Stable No. 12: Seven cows. None sick. No information.
- Stable No. 13: Eleven cows. None sick.
- Stable No. 14: Fifty-six cows. One acute and four chronic cases of pleuro-pneumonia. Have lost heavily in past years.
- Stable No. 15: Eighteen cows. Five sick with acute lung disease within two months, of which three died.
- Stable No. 16: Forty-two cows. Acknowledge a loss of over 200 cows from lung disease within three years. Several now coughing.
- Stable No. 17: Fifty animals. No disease.
- Stable No. 18: Thirty-six animals. No disease.
- Stable No. 19: Original herd 12 animals. Three died during September and October. Calf died in October which State Veterinarian examined and pronounced affected with pleuro-pneumonia. Three still sick with same disease. First cow to sicken came from another stable in Baltimore within a few weeks.

The herds in the nineteen stables referred to above contained 398 animals, of which 12 were found to be sick or only partially recovered at the time of inspection; 3 cows had recently been exchanged while sick, and 18 recent deaths had occurred. The total number of animals which had recently sickened with symptoms of pleuro-pneumonia in the above stables was, consequently, 33, or 8.3 per cent.

This inspection, while it cannot be taken as a very accurate indication of the proportion of the Baltimore dairy cattle which are constantly affected with pleuro-pneumonia, is nevertheless sufficient to show that a very large proportion of the stables are infected, and that many cases of the disease occur.

A considerable number of inoculation and cohabitation experiments have been made and are still in progress, and will be given in detail in the First Annual Report of the Bureau of Animal Industry.

The following statement was prepared for the use of the House Committee on Agriculture in January, 1884:

EXTENT OF PLEURO-PNEUMONIA AND THE IMPORTANCE OF NATIONAL ACTION IN REGARD TO THE CONTAGIOUS DISEASES OF ANIMALS.

The extent of territory infected with contagious pleuro-pneumonia of cattle and the number of animals actually suffering from this disease, are insignificant in comparison with the annual direct and indirect losses traceable to it, and the danger to which our immense live-stock industry is continually subjected.

In Connecticut two herds were infected during the past summer, in which 12 animals were exposed and 7 contracted the disease. In one of these herds the affected animal was destroyed, and at last accounts no others had contracted the disease; in the other herd 4 animals had died, or had been killed, and 2 with very extensively diseased lungs remained in quarantine. Both of these were Jerseys, and the owner refused to have them destroyed. What has been done with them, or what will be, I am unable to say, as the State authorities seem powerless to proceed beyond quarantine, and this seems to have been by no means secure.

In the State of New York, although the disease is almost entirely confined to the western end of Long Island, to Staten Island, and New York City, these localities are quite extensively infected, and as there are more than two thousand stables, some of which contain several hundred cows, and many of which contain from 50 to 100, it is the most dangerous district in the country at this time. Recent reports are to the effect that the disease is extending through the river counties, and exists in herds located from 50 to 60 miles north of New York City. How many cattle are affected in these counties I am unable to say, but the existence of the disease here is really of much greater importance to the country at large than the number of diseased animals would lead one to suppose, because it is a district where many thoroughbred cattle are raised and from which they are shipped to all parts of the United States.

New Jersey was recently supposed to be nearly free from pleuro-pneumonia, but the fact that a number of cases occurred without the knowledge of the State authorities, that a still larger number of herds were lately known to be infected in Union and Essex Counties, and that a very extensive outbreak in Hunterdon County was recently traced by means of sick cattle shipped to the New York market, and discovered by the inspector employed by the United States Department of Agriculture who is stationed at Jersey City, leads to the suspicion that a thorough inspection of the State might bring to light still other cases. The Hunterdon County outbreak was one of the most extensive that has recently occurred. It was supposed to have originated from a car-load of cows brought from Pennsylvania; but where these were in-

fectured is not known. Seven herds, at last accounts, were in quarantine; and as all were large herds, containing from 40 to 70 cattle, a large number of animals were exposed.

Inoculation was extensively practiced to check the fatality; but, in spite of this, reliable authority places the loss at over 50 head.

In Pennsylvania there has recently been another very extensive outbreak, which was the result of taking a car-load of 14 cows from the Calvert stock-yards in Baltimore to Chester County. Most of these cows were taken into large dairy herds, which they thoroughly infected. In each of these cases the Baltimore cows were the first to sicken, and a large proportion of the native cattle were soon affected with the same disease. These herds were visited the 3d of October by the Veterinarian of the Department of Agriculture, in company with the State authorities, who killed 8 of the animals in his presence in order to satisfy him as to the nature of the disease. The cases were typical cases of pleuro-pneumonia, and all those appearances were present which were recently accepted by the International Veterinary Congress held at Brussels as characteristic of contagious pleuro-pneumonia. In most cases a whole lung was hepatized; the inflammation was of different ages, showing the progressive character of the disease; the interlobular tissue was greatly distended with the exudation, and the pleurisy was intense. According to an official report, dated October 30, the number of animals known to have been exposed was 104, and the number of sick ones that had been killed or had died was 46. A semi-official report of the present month places the number destroyed at 70. It is now believed that the disease has been entirely overcome, and that the State of Pennsylvania is free from it.

In Maryland and the District of Columbia there are many infected herds in which a comparatively large number of animals annually contract the disease. By direction of the Commissioner of Agriculture a reliable Inspector was sent to Baltimore late, in October, to learn the condition of the stables there as regards this disease.

Nineteen stables, containing 398 animals, were examined. In twelve of these the infection was admitted; one had lost more than 200 animals within three years; others had lost heavily for years; 12 sick animals were found, 18 recent deaths were admitted, and 3 sick cows had just been sold or exchanged. This number of stables comprises but a small part of those in the vicinity of Baltimore, but it is believed that the number is sufficient to demonstrate the presence and dangerous character of the disease. We have no information of pleuro-pneumonia in the country districts of Maryland at any great distance from the cities.

One or more herds near the District of Columbia have recently lost a number of cows, and at latest accounts had some sick. Within the District, without making any regular inspection, three infected herds have been found where from 3 to 6 animals are admitted to have been lost within the year. In Virginia there are stables from which animals have recently been lost with symptoms of this disease; but none of these could be secured for examination, and therefore we can not be positive in regard to the nature of the disease.

REASONS FOR BELIEVING IT CONTAGIOUS.

The first great reason for believing this to be contagious pleuro-pneumonia is the fact that nowhere in the country outside of the comparatively small strip of territory stretching from Connecticut to Virginia, and east of the Alleghany Mountains, have any cases been found which bear any close resemblance to the disease under consideration. If this disease were the result of climatic causes, or if it were produced by improper food and care, then we should certainly find it distributed over the whole country, or at least in all of those parts of it where similar conditions exist. It cannot be originated by the manner of stabling and feeding cows near our Eastern cities, for substantially the same conditions exist at Rochester, Buffalo, Cleveland, Detroit, Chicago, Saint Louis, Cincinnati, and other Western cities, and no veterinarian has

been able to find any similar cases of disease there, although special inspection has been made by competent persons.

The disease is not confined to stable cows, however, nor to those seasons of the year when acute lung diseases can be accounted for by the inclemency of the weather. The outbreak referred to in Connecticut occurred in the summer, in a country district, and where the cattle were running upon nice pasture fields. The extensive outbreaks in New Jersey and Pennsylvania also happened in summer, and were in the best farming districts of these States.

In this connection attention is called to the fact that in the State of Pennsylvania about ninety herds have been infected since March, 1879, and that notwithstanding the appointment of special agents in every part of the State, and the investigation of all cattle diseases wherever found, there was no disease resembling pleuro-pneumonia discovered except in eight of the sixty-seven counties of that State. The remaining fifty-nine counties have been free from any suspicion of this plague. What is even more significant is the fact that these counties are not distributed over various parts of the State, but that they join each other, and are all in the southeastern corner of the State, where there is the greatest danger of infection by cattle brought from Philadelphia and Baltimore. With seventeen of these herds the infection was traced to cattle from Baltimore or other points in Maryland; with twenty-one it was traced to Philadelphia; with ten it was traced to cattle from herds in Pennsylvania known to be diseased.

The most favorable conditions of life were not sufficient to protect the cattle where this disease was introduced. I have already mentioned that a number of the outbreaks referred to occurred during the summer, and that the animals were running upon irrefragable pasture fields. Many of the affected cows were young and in fine condition. In Connecticut a Jersey bull, less than two years old, and two steers fit for beef, were among the victims. Again, the disease as we see it here does not occur in isolated herds a single case at a time, as does non-infectious lung disease, but when it enters a herd a majority of the cattle are affected sooner or later. Some of the herds in Brooklyn and Baltimore have been losing cows from this plague for years, and one near the latter city, where but about fifty cows were kept at a time, has lost between 200 and 300 cows within three years.

These instances, all recent, are referred to, not as all the evidence bearing on this point, but simply as examples of what has been occurring for years past; and it is believed that they cannot be explained on any other hypothesis than the contagiousness of the disease.

DANGER GREATER THAN EXTENT OF INFECTED TERRITORY AND NUMBER OF DISEASED ANIMALS WOULD INDICATE.

Glancing over the territory which I have stated to be infected, it must be confessed that it is not extensive—a single farm with perhaps five animals in Connecticut, about four counties in New York, as many in New Jersey, two or three counties in Maryland, and possibly a few stables in Delaware and Virginia.

In most of the infected herds there are but one or two sick animals at a time, and frequently there are none; for where the disease has existed for a certain time the susceptible animals die off and only those which possess a certain immunity from it remain.

As about 20 per cent. of all the animals exposed are able to resist the contagion indefinitely, a herd of comparatively insusceptible cattle is in time acquired, and the time necessary for this is shortened both in Baltimore and Brooklyn by the practice of inoculation.

But these stables and grounds remain infected, and a large portion of the new cows brought into them contract the disease unless they are previously protected by inoculation. The practice of inoculation does not destroy the infection; on the other hand it keeps it up, but it enables dairymen to keep their cows in infected stables

without great loss, when without it more than half of the new cows brought into them would surely die.

Another fact of great importance brought out by the experiments of the French pleuro-pneumonia commission is that about 30 per cent. of the animals exposed to this disease show no symptoms of it beyond a slight cough. Such animals are probably as dangerous to others as those which have it in a more severe form, and yet they can be transported to various parts of the country without exciting the least suspicion.

The animal which is supposed to have caused the outbreak in Connecticut was probably in this condition, as a careful examination of her lungs did not enable the veterinarians to detect any evidences of the disease; and yet pleuro-pneumonia existed in the stable from which she came, and her admission into the new herd was followed by the seven cases that have been mentioned. Similar instances are referred to again and again by the veterinarians of every country where the disease exists.

These infected districts, though small, are then a real danger to the whole country, because all the way from Connecticut to Virginia there is a large and increasing number of herds of thoroughbred cattle, which are frequently shipped to the West and some of which have from time to time been infected with this disease. Fortunately, the owners of thoroughbred cattle have generally had too much regard for their reputation to ship cattle when there was any disease in their herds, and the common cattle have not been sent to a sufficient distance to do much harm.

But with the increased price of cattle a large number are being shipped from the East toward the West, and the danger of carrying the disease is consequently increasing. If the car-load of cattle shipped from Baltimore to Chester County, Pennsylvania, had gone to the ranges of the West, they might have done irreparable harm. Again, the thoroughbred Jersey cow which went from an infected stable in New Jersey might as readily have been shipped to the West; and I have been informed that if the Connecticut outbreak had occurred a few months later one or more of the herds would have been sent, according to contract, to a Western State. Now, while it is true that pleuro-pneumonia has existed in the East for forty years without having been carried to the West, it must be admitted, from what has occurred so many times in Pennsylvania and Connecticut, that there has been danger of this, and that this danger is increasing with the larger number of cattle now being shipped in that direction. No doubt this danger has been exaggerated, but the fact that there is danger, and that the disease once carried to the Western herding grounds would probably be beyond our control, if we can judge from the experience of Australia and South Africa, is sufficient to show the importance of grappling with it while it can be so easily handled. The rapidity with which a disease spreads on these ranges, when once introduced, is illustrated by an occurrence of last summer in Southwestern Texas. A drove of cattle brought a communicable disease to that section, which the army surgeons believed to be contagious pleuro-pneumonia; but before any careful examination could be made several hundred cattle had died, and a large territory was infected. Fortunately, investigation showed that this was not pleuro-pneumonia, but a disease which does not outlast a single season of the year. If it had proved to be pleuro-pneumonia, would it not have been a national calamity? With a large territory already infected, with no money and no power to control the disease, and occurring in summer months, before the State and national legislative bodies would convene, it is difficult to see how any effective measure could have been adopted.

THE INEFFICIENCY OF STATE ACTION.

Though a number of attempts have been made by the States now infected to rid themselves of pleuro-pneumonia these have generally or always failed, because for various reasons the work was not thoroughly done. We saw the State authorities of Connecticut unable to exterminate the disease a few months ago, when but a single herd contained sick animals. The stables of Brooklyn were never under complete supervision, and some could not be entered by the inspectors even when the

State of New York was most active in the endeavors at extirpation; and though the authorities of New Jersey have been engaged at the same task for five years, the State has probably never during that time been entirely free from pleuro-pneumonia. In Maryland the assertion has been made again and again that there were no cases of this disease in the State, and yet during any part of this time a thorough inspection could not have failed to reveal a considerable number. At best the attempts of the States have been spasmodic; and while one State was earnestly striving to accomplish something a neighboring one would allow the shipment of diseased cattle, and counteract the influence of the former. As a rule, therefore, State action has never been thorough, and the lack of unity of action between the States has prevented any lasting benefit even when much has been accomplished.

ADVANTAGES OF THE WORK BEING DIRECTED BY THE UNITED STATES GOVERNMENT.

A national direction of the work for the extermination of pleuro-pneumonia would overcome at once the discouraging features which have done so much to prevent the efforts of the individual States from being effective. With inspections in every infected State the shipment of diseased cattle would soon cease; new outbreaks would thus be prevented, and the danger which has so long menaced the great cattle interests of the country would be removed. The work would be more thorough and energetic, because those engaged in it would not be directly or indirectly dependent upon the good-will of the interested cattle owners for their positions, and the plea of inability to pay for the diseased cattle which ought to be slaughtered would also be overcome. These have been the principal obstacles to the success of State action, and practically they are so great as to make it next to impossible for the States alone to free themselves from this plague.

THE PRESENCE OF PLEURO-PNEUMONIA COSTS ANNUALLY MORE THAN WOULD BE NECESSARY FOR ITS DESTRUCTION.

Owing to the presence of pleuro-pneumonia in the United States, every steer shipped to Great Britain must be slaughtered within a certain time on the wharf where he is landed. This restriction upon the export cattle trade is said by competent authorities to make the price of our steers average \$10 less than similar animals shipped from Canada. With over 100,000 beeves going abroad every year, this makes a loss of \$1,000,000 annually, or enough to clear our country of the disease. Besides this, there are the continual losses which are going on in the infected districts, and the disturbed condition of trade from the many false alarms in regard to the spread of this disease, the entire annual losses being estimated by good authorities as high as \$3,000,000.

IMPORTANCE OF INVESTIGATING OTHER DISEASES.

The proposition of establishing a permanent bureau for investigating the communicable diseases of animals is a matter of the greatest importance. While we have no more disease than other countries in proportion to the number of our animals, the enormous development of our live-stock industry has made the question of contagious diseases one of peculiar interest to us. The cause of these plagues, which has been an impenetrable mystery during all the past ages of the world, is being revealed by the science of to-day, and the infinitely small organisms which are able to produce such terrible havoc in our flocks and herds are at last being brought under subjection themselves, and their study has revealed much of the greatest value to us in our warfare against them. A country with so much at stake, with millions of dollars annually swept away by this class of maladies, cannot afford to be idle. Other nations which have much less capital invested in animals than we have, see the necessity for this work and are making provisions for it; and it is to the credit of our country that we were one of the first to enter this field, and that results have been accomplished which will bear comparison with the investigations of any other country.

But while much has been done, while millions of dollars have already been saved to our farmers by the facts thus far discovered, we have only made a beginning in the great work that is before us. Some of the most important diseases affecting our animals are still mysteries to us, and though they are distributed over large territories and decimate the live stock, we are ignorant of their cause; we do not know how they are kept up from year to year; we have no means of combating them, and the idea of freeing ourselves from their ravages has scarcely dawned upon us. A striking example of the necessity of such work is seen in the recent investigations of Texas cattle fever. This disease has been advancing and infecting new territory for a century, and until the last year or two we knew nothing about it, and our best informed veterinarians and stockmen did not suppose that it was found in one-fifth of the territory which it has actually overrun. These were points which it was necessary to understand before either legislative bodies or individuals could adopt intelligent measures for preventing the annual losses which have been most discouraging to the cattle industry in large sections of the country. And with every disease there are equally important points still to be investigated.

The laboratory and experiment station which have been fitted up during the past summer under the direction of the Commissioner of Agriculture, for investigating contagious diseases, make it possible to attempt the solution of questions which were formerly beyond our reach. The laboratory contains the most improved apparatus for such investigations, much of which was constructed according to new designs, especially for this work, and it is safe to say that the facilities here are now equal to those possessed by investigators of similar diseases in any country, and in some respects they greatly surpass them.

In conclusion, I would say there is not a department of original research or of agricultural investigation in regard to which there is more pressing need for development than this, and none which promises to effect a greater saving. Our losses are now heavy, but they must increase as our animal population increases, as new diseases are introduced, and fresh areas are infected. But it is not alone a question of dollars; the investigation of animal contagia must throw new light on those human plagues which in our country alone sweep a quarter of a million of human lives out of existence each year. Some of these animal diseases are communicable to man, and have a greater influence over our health and lives than is generally supposed, and any means of controlling them cannot fail to have an important influence on human health as well.

ENZOOTICS OF ERGOTISM.

Early in March, 1884, a disease among the cattle of Coffey County, Kansas, which was supposed by certain veterinarians to be foot-and-mouth disease in a most virulent form, was brought to the attention of the officers of that State; and such exaggerated accounts were sent to the press from day to day as to cause a feeling of insecurity and alarm among all engaged in the live-stock industry of the West. The 3d of March, Dr. Wilhite visited the farm of Mr. Daniel Keith, located in Coffey County, 4 miles northwest of Neosho Falls, and pronounced the trouble among his cattle to be foot-and-mouth disease. The same day Governor Glick telegraphed as follows:

TOPEKA, KANS., March 3, 1884.

Hon. GEO. B. LORING,

Commissioner of Agriculture.

A very malignant disease has broken out among the cattle in Neosho County, this State. It is supposed to be the foot-and-mouth disease. The feet become sore and

soon rot off. The disease sometimes extends to the knees. Over a hundred animals have been attacked in a few days. Great consternation among the cattle owners. Can your Department send here a competent veterinary surgeon? No one here can advise what to do.

G. W. GLICK, *Governor of Kansas.*

Two days later the following dispatch was received :

TOPEKA, KANS., *March 5, 1884.*

HON. GEO. B. LORING,

Commissioner of Agriculture :

Veterinary surgeon reports disease of which I advised you to be foot-and-mouth disease.

G. W. GLICK, *Governor of Kansas.*

On the receipt of this dispatch, and similar representations by the Senators from Kansas, Dr. M. R. Trumbower, a veterinarian whose previous reports of various diseases had led us to put great confidence in his knowledge and judgment, was directed to proceed at once to Neosho Falls, and make an early report in regard to the nature of the disease among cattle which was said to exist at that place. He started on the 6th, but could not reach the affected farms until the 9th of March.

In the mean time, at the request of the governor, General Augur detailed Dr. Holcombe, of the army veterinary service, to make an immediate investigation. In company with the governor, the secretary of the State Board of Agriculture, and a delegation of citizens from Emporia, Dr. Holcombe reached Neosho Falls March 6, and after a hurried examination of the Keith, Goodrich, and Beard herds he reported that the disease was the genuine epizootic aphtha of Europe. The following dispatch was received at the Department of Agriculture the same day :

NEOSHO FALLS, KANS., *March 6.*

HON. GEO. B. LORING,

Commissioner of Agriculture :

Veterinary surgeons A. A. Holcomb and A. H. Wilbite have to-day made an examination of the infected cattle, and pronounce it foot-and-mouth disease. Over 100 head are affected, but the disease is confined to stock cattle on a half dozen farms.

G. W. GLICK, *Governor of Kansas.*

When Dr. Trumbower reached Neosho Falls, he found an excited throng of people who urged upon him the necessity of making an immediate diagnosis, and relying rather upon the representations of others, which in many important respects proved to be incorrect, than upon what he was actually able to see, and a careful judgment based upon this alone, he was led to concur in the opinion of the professional gentlemen who had been upon the ground for the preceding three or four days.

On March 10, Dr. Holcombe made his formal report to the governor, in which occurred the following sentence :

That it is foot-and-mouth disease cannot be doubted when the symptoms are considered ; for to recapitulate, the various cases show vesicles and ulcers of the mouth ; vesicles and ulcers in the cleft of the hoof ; suppuratation and sloughing at the foot ; ulcers

of the rectum; vesicles and ulcers of the udder; diarrhea; a temperature varying from 101 to 104.4 degrees Fahr., and the most remarkable emaciation even in cases where the appetite is good.

The excitement now became so great that by your direction I left Washington, March 13, to investigate the nature of the disease and to see what action, if any, was necessary to hold it in check. At Chicago I learned of what was supposed to be a similar outbreak at Effingham, Ill., and was requested by Dr. Rauch, secretary of the State Board of Health, and by others largely interested in the cattle industries of the State, to make an immediate investigation. The condition of affairs in Kansas, however, was so urgent that I concluded to press on as rapidly as possible.

I reached Topeka March 15, and immediately had an interview with the governor and with the secretary of the State Board of Agriculture. I was informed by both that the malady was undoubtedly foot-and-mouth disease, but that it was so quarantined that there was little danger of its immediate extension; and at the request of the governor I proceeded the following day to Pawnee County, to investigate a supposed outbreak of pleuro-pneumonia. I found the cattle there to be suffering from chronic indigestion, the result of feeding too exclusively for a long time on dried sorghum with a probably insufficient water supply.

I at once returned, reaching Neosho Falls March 19, and after a careful investigation was able to telegraph you on the 21st that the affection was not foot-and-mouth disease, but that it had been produced by local causes and that there was no danger of its spreading.

Returning through Topeka, I reported my conclusion to the governor and was informed that experiments would be made with susceptible animals to decide the nature of the disease. I was invited to assist in these experiments, and at first decided to do so, but I soon learned that the investigation necessary to satisfy Dr. Holcombe, who had just been appointed State veterinarian, was such as to require much more time than I could give to it. I accordingly visited Kirksville, Mo., by your direction, where I found an outbreak of the same disease as existed at Neosho Falls, and from there returned to Washington.

In Kansas I met Professor Stalker, of Iowa, Professor Faville, of Colorado, Colonel Groom, of Texas, and Dr. Hopkins, of Wyoming, who had been commissioned by their respective States to report on the nature of the disease and the necessity of quarantining all cattle, sheep, and pigs from Kansas. I was also requested by the secretary of the Illinois State board of health to inform him if there was any necessity for his State to adopt similar measures. Fortunately, each of these States received a report that foot-and-mouth disease did not exist in Kansas, and what threatened to be an almost complete suspension of the live-stock business of the West was averted. There is no doubt, however, that the cattle industry suffered a considerable loss from the

excitement. The market became unsteady, the price of cattle declined, and buyers became exceedingly cautious.

April 9 I received information that Dr. McEachran, principal of the Montreal veterinary school and live-stock inspector for Canada, had visited Neosho Falls, Kans., and Effingham, Ill., as the representative of the Canadian Government, and positively asserted that the malady at both places was the real foot-and-mouth disease of Europe. April 10, a telegram from the State agent for Kansas of the United States Department of Agriculture conveyed the information that the State veterinarian had just reported to the governor that six healthy cattle cohabited with the sick animals had all contracted the disease, and that further experiments by inoculation would at once be made. A letter from the governor of the same date, received two days later, contained similar statements. A few days later still an item appeared in the press dispatches from Washington, stating that "a private dispatch was received here to day from the governor of Kansas, saying that cases of sickness among cattle which had been most carefully examined had turned out to be true foot-and-mouth disease. He was afraid that some cases had got in the herds. There was an attempt made at first to keep the matter quiet, but the information was deemed such as should go to the public."

It now seemed that a repetition of the former excitement and panic was about to occur, and by your direction I visited Kansas a second time with instructions to make such experiments as might be necessary to demonstrate the non-contagious nature of the disease beyond question. I reached Emporia April 20, and was there met by a telegram from Neosho Falls asking me to join the State veterinarian and Professor Law at the governor's office on the morning of the 22d. Not intending to turn backward until the difference of opinion was conclusively settled, I telegraphed in reply requesting these gentlemen to meet me at Emporia on their way to Topeka. This they did on March 21, and I had a conference with them, at which the State veterinarian admitted that all attempts to convey the disease by inoculation upon cattle, rabbits, and sheep had failed; that the second experimental lot of cattle which had cohabited with the first lot when they were supposed to be suffering with foot-and-mouth disease had not been in the least affected; that the foot symptoms of the first lot had only been noticed with two animals, were very slight and of exceedingly short duration; and that, finally, whatever the disease might be, it was not the continental foot-and-mouth disease.

After receiving this information I returned to Topeka, attended the meeting of the live stock commission in the governor's office, when the State veterinarian reported that the malady at Neosho Falls was not the foot-and-mouth disease, and the governor sent out a dispatch to the same effect.

On my way to Washington I visited the herds in the vicinity of Effing-

ham, Ill., examined the cattle and the food and assured myself that the disease there was identical with that in Kansas and Missouri, and that it was in every case traceable to the ergot which existed in great abundance in the hay.

SITUATION OF THE AFFECTED HERDS AND BRIEF HISTORY OF THE DISEASE.

The cattle disease in Kansas which recently attracted so much attention from its supposed identity with the contagious foot-and-mouth disease of Europe, was first noticed in the herd of Daniel Keith about the 23d or 24th of December, 1883. Mr. Keith's farm is located 4 miles northwest of Neosho Falls. The first to sicken were some yearlings, which were noticed in the morning standing "humped up," with drooping heads and jerking the hind feet in a peculiar manner. These would walk but little and would soon lie down. Within two or three days they were inclined to lie continually. The feet were examined and found free from mud; the interdigital space was described as red, swollen, and sensitive, the toes spread apart. The feet began to swell at the coronet, or as high as the fetlock; a line of separation was established, and pus appeared within two or three days from the first symptoms. The mouths were not examined, but the animals were supposed to be eating all right.

On or about December 10, Mr. Keith had purchased 63 head of yearlings of Mr. Davis, all of which had been gathered within a radius of 10 miles. Two cows and 6 yearlings were bought of Alexander Linn, 1 mile down the river from Neosho Falls. This lot of yearlings were said to have sickened within a few days after their arrival on the Keith farm; it is believed that some were sick within three days and that all were suffering within a week, and during this time they had been fed on shelled corn and mowed oats. There appears to be some doubt as to how severely they were affected, whether they were all attacked on the same day, and the exact number of days they were on the farm before showing any symptoms. While it was asserted that they ate no hay it was admitted that there was probably some hay in the racks. Eight other animals were purchased about the same time of neighbors living within 2 or 3 miles.

By January 1 he had between 20 and 30 head sick, a number of new cases being observed each day. March 9 Dr. Trumbower found a red yearling steer with a very hot mouth, mucus membranes much reddened, a vesicle the size of a dime on the soft palate, and two smaller ones on the tongue. There was also a small ulcer on the mucous membrane of the rectum; the temperature was 104.4° F.; the animal was lying down, and when forced to rise it moved very stiffly, but there was no swelling of the feet. The following day the vesicles were found ruptured, in their place was a deep, red cavity which bled when touched. Temperature still 104.4°. March 20 this animal appeared well.

The cattle on this farm were divided into two lots, which were in adjoining inclosures, and were separated only by rail fences. The second lot contained 40 two-year-old steers, purchased about November 1, and was free from disease until February 28, though some of these had broken through the fence at times and mingled with the diseased part of the herd. March 10 about 10 or 12 animals in the second lot were sick. Three days later Dr. Trumbower found 2 that would lose all four feet. At this time there were 118 head of cattle on the farm, of which 74 were more or less affected. Nine animals had one foot off, 4 had two feet off, 1 four-year-old cow lost both hind feet and a toe from one fore foot, 3 others were affected in but one foot, 6 in two feet, and 1 in three feet. In nearly all that showed lameness there were more or less mouth symptoms.

Across the road, and nearly opposite to Mr. Keith, lives Edward Hindman. It was here that the cattle belonging to A. C. Goodrich were located. The 10th of March this herd numbered 96 head. The first animal affected was a milch cow, noticed to be lame January 10. No other cases occurred until February 14 or 15, when one was seen to be lame in the morning after a heavy ice storm. The following morning 16 were lame. After that he discovered new cases almost daily, and on March 14, when they were separated from the well ones, 65 head were affected. March 19 the most severe cases were as follows: 18 animals had lost both hind feet, 5 had lost one hind foot, 1 had lost both hind feet and one fore foot, and 1 had lost all of its feet. Seven of the others were lame in the hind feet, and the remainder of the 65 head affected were more or less lame.

In each of the above-mentioned herds the sick animals at the time of my visits, March 19 and 22, had small erosions of the mucous membrane of the mouth, and 2 or 3 had hard yellowish crusts in the same situation an inch or more in extent. In no case were these sufficient to interfere with mastication. This lesion was more noticeable in the old chronic cases than in the recent ones.

The third herd which contained diseased animals was located about $2\frac{1}{2}$ miles from those already mentioned. It belonged to J. W. Beard. This herd contained 70 head of animals, and 3 cows and 2 steers are all that have been affected. All had been running together until the disease was noticed, when the sick were separated from the well. The first symptoms were observed on the 17th of February, when a cow was seen to be lame. The second one to go lame was a cow bought of Mr. Keith and brought to the farm February 18—she became lame about the 22d or 29th, accounts differing between these dates. The third one, a steer, became affected March 1. The fourth was a cow observed to be sick March 1 or 2. It is reported that she slavered very profusely. Mr. Beard states that he examined her mouth and found it very red and the tongue covered with little pimples. At ten o'clock next morning she died. This animal had not been lame. The fifth one was taken about

the same time. It was lame in one foot, became better, was affected in a second foot, and was entirely recovered from lameness by March 11. At this time Dr. Trumbower found several small sores and discolored spots in the mouth, and the temperature was 102.5 degrees, or very nearly the average of cattle in health. The highest temperature found by Dr. Trumbower was that of the cow purchased of Mr. Keith, which reached 102.8 degrees—a point too low to indicate fever with any certainty.

The fourth and only remaining herd in the neighborhood of Neosho Falls was that of Christian Pribbernow, whose farm is located on Owl Creek, 10 miles southeast of the town. There were on this farm 183 head of cattle, and but 16 have shown any signs of the disease. This herd was made up as follows: 54 yearlings, 24 two-year-old steers, 13 two-year-old heifers with calf, 15 three-year-old steers, and 77 cows and heifers. The yearlings had been put in a separate pen and fed on oats and corn-fodder—none of these were affected. Three apparently well animals were lassoed and examined; their mouths contained small erosions and discolorations of the mucous membranes. The temperature of one, thought to be slightly lame, was 101 degrees; that of another, apparently in perfect health, was 103 degrees. Six of the affected ones have either lost their feet or have them in such condition that they will surely separate from the legs, and 2 others have lost digital bones. None of these animals have shown salivation or loss of appetite; but the mouths contained erosions and discolorations similar to those seen in other herds.

At Hall's Summit, a distance of 20 or 25 miles north from Neosho Falls, George R. Smith owned 2 cows. About February 1 one became lame; there was noticeable slaving and loss of appetite for several days. This cow calved February 23, and Dr. Trumbower saw her March 17, when the calf appeared well but small. The cow was reduced to a skeleton. Her right hind leg had broken off half way between the fetlock and hock joints, carrying with it the lower half of the metatarsal bone. The left hind leg was separating at about the same point. One toe of the left fore foot was coming off at the first joint.

Near Hartford, some 20 miles northwest of Neosho Falls and 15 miles west of Hall's Summit, was the farm of Mr. O'Toole, where another outbreak of disease occurred, showing precisely the same symptoms. The animals at this place were reported to have been killed before my visit, and consequently I did not see the herd. Dr. Wilhite, as I was informed, thought the first cases appeared about January 10. The first animals attacked were yearlings. Soon after all the calves became affected in the same way. Then the large steers in the feeding pen were attacked.

About the middle of March the governor of Kansas sent a veterinarian to investigate a disease which was reported to exist in Osborne County. According to verbal information which I received from the

State officers while at Topeka, this disease was substantially the same as that which existed at Neosho Falls. The distance between these two points must be at least 175 miles in a direct line.

After investigating the disease in the neighborhood of Neosho Falls, I proceeded as directed to Kirksville, Adair County, Missouri, to visit herds at that place reported to be affected with foot-and-mouth disease. On March 27 I was at the farm of William Bragg, who lived 5 miles south of Kirksville. The disease in this section was first noticed here, but later 6 other herds, within a radius of 4 miles, have had affected animals. The only new animal introduced on the Bragg farm was a steer bought in the neighborhood about December 20. This was one of the first to sicken, but there was no disease on the farm from which it came. A cow that had been purchased a month earlier sickened about the same time. This was in the latter part of January. The weather had been extremely cold early in January, and reached 10° or 12° below zero at other times during the month.

At the time of my first visit there were 4 animals lying in the stable. One cow had lost a hind leg from about half way between the hock and fetlock joints; the bones had separated at the latter joint and the metatarsal bone protruded half its length beyond the flesh. The other hind leg was dividing at the fetlock joint. Six inches at the end of the tail was gangrenous, and was being separated from the remainder of the organ. There were a number of abrasions and small discolored spots in the mouth. A second cow had a healthy mouth; both hind feet were lost at the coronet, and the tip of the tail was gangrenous. A steer, probably two years old, had lost both hind feet at the fetlock, about an inch of the tail was lifeless, and the mouth contained a number of sores and discolorations. A second steer was in almost precisely the same condition. A third steer was walking around the yard, very lame, and had a large slough of the tissues on the posterior surface of the fetlock joint. A fourth steer in the pasture had both limbs as high as and including the fetlock joint stiff and cold. Still another animal was lame in the hind limb. Seven herds within a radius of 4 miles had suffered. Six abortions were reported.

April 24 and 25 I visited a number of the diseased herds in Effingham and adjoining counties in Illinois. The farm of Lemuel Faunce is situated 10 miles northeast of Effingham and one and one-half miles from Montrose. The first cases appeared in the latter part of December, and began with diarrhea and other signs of digestive disturbance. There were 21 head of cattle on the farm and no new ones had been purchased at the time of or immediately preceding the outbreak. Two cows, each of which had both hind legs affected, had been killed before my visit; 1 steer has a hind limb off at the fetlock; another has a clear line of demarcation formed at the fetlock, the part below being gangrenous; a bull has lost both toes from one foot and one toe from the other; 2 other animals were very stiff. One steer had two attacks and another had

three attacks of lameness, and the latter entirely recovered. The animal that was first to suffer still had sores, *i. e.*, erosions of the mucous membrane on the upper lip and gums exactly like those which I saw when examining the affected cattle at Neosho Falls and at Kirksville, though four months had elapsed since the appearance of the disease. Some of the sick ones had slavered and smacked the lips, showing that the mouth was quite severely affected.

The horses on this farm had also been troubled with an eruption in the mouths which had caused salivation and loud smacking of the tongue and lips. These were now entirely recovered, though slight evidences of the sores on the lips were still visible. The horses were seen to have lost appetite in January or early in February. The last of February sores were observed in the mouths, and it was six weeks before these healed. Only one hog was kept, though many of the neighbors' hogs had been continually running around the pastures. None of these had been affected.

Three miles north and 1 mile west of Mr. Faunce's farm, Mr. Dubroc had yearlings in a high, dry lot, in which was an out-house for shelter, partly filled with hay. All of these were affected and all recovered. There were here 160 head of cattle, only 8 or 10 of which, all told, were lame. Ten or 12 goats were running with the cattle, but remained well; the two places mentioned above were so situated on different roads that there was little if any passing from one to the other, and the outbreaks were therefore independent of each other.

Other cases of the disease occurred on the farm of Mr. John Mason, who lives near Wheeler in Jasper County. This gentleman owned 120 head of cattle, of which 17 had been affected. Six animals were so bad that they had been killed; 2 others remained, one of which had lost a foot, and the second one would lose both of the posterior feet at or above the fetlock; a part of the tail of this one was also gangrenous. Nine others had been more or less lame but had lost no limbs. On this farm and in close proximity to the cattle were 25 horses and mules, 100 hogs and 40 sheep, all of which had been free from disease.

In the town of Wheeler, a single family cow was found with the lower parts of the posterior limbs separating as a result of dry gangrene. This seemed to be the only sick animal in the town.

Mr. Keating, who lives 6 or 8 miles from Effingham, had also suffered from the same disease. His herd consisted of 45 young cattle and 6 cows. None of the cows were affected, and it is worthy of remark here that they had been fed upon hay harvested in 1882. The young cattle were fed upon the crop of 1883, and of these 8, which were in a very bad condition from the loss of their limbs, had been killed; two others were still alive with the feet off at the fetlock. About half of the 45 young cattle were more or less affected. There were 60 sheep and a number of hogs on this farm, none of which had shown any signs of disease. The cattle here were attacked about the 8th of January.

These farms are mentioned as examples of what had occurred at seventeen or eighteen different places that I learned of within a radius of 15 miles from Effingham. As a matter of great interest connected with this subject, I was informed by a number of people that there had been a greater number of abortions among mares, and more cases of difficult parturition during the past winter and spring than was ever known before.

Other herds were reported on good authority to be affected in the same manner at different points in Missouri, Illinois, Iowa, and Colorado.

CLASS, CONDITION, SURROUNDINGS, AND CARE OF THE ANIMALS.

All the diseased animals on the farms visited by me were stock cattle in medium to thin condition. Those worst affected, in which one or more limbs were separating as a consequence of dry gangrene, had evidently lost much flesh during the progress of the disease. There were no fat cattle on any of these farms. At Mr. O'Toole's it was said by those who visited the place the fattening cattle were attacked as well as the stock cattle and calves.

On most of the farms there were cattle of all ages—calves, yearlings, two-year-olds, three-year-olds, and cows. The calves and yearlings seemed to escape in a greater degree than the older cattle. In the Goodrich herd were 20 calves which occupied a lot through which the other animals were frequently driven to water and into which some of the lame ones were placed. This lot was separated by an open fence from that in which were kept the worst diseased animals of the herd, and yet not one of the calves suffered in the least. At Pribbernow's were 54 yearlings running with the other cattle, and from which the worst affected ones were only separated by a rail fence, and all of these escaped. At Keith's were 2 young calves sucking diseased mothers, but themselves in good health. Here also were hogs and a litter of young pigs running in the same lot with the sick cattle, but free from any signs of disease. At Kirksville sheep had been running with the cattle and were also healthy. In Illinois, sheep, swine, and goats mingled with the affected herds with perfect safety.

The winter has undoubtedly been a severe one upon the stock of the Western States, and the cattle were consequently somewhat below the average condition at this season of the year. The appearance of the disease cannot be explained by this fact, however, since thousands of healthy herds were in worse condition than those on the farms in question. Some of these herds, and noticeably that of Goodrich, were in much better than average condition; they had evidently been well fed and cared for.

There was nothing in the surroundings of the affected animals which would explain the development of the disease. The feeding lots in most cases were unusually dry and the disease had appeared at a time

when all mud was frozen solid. The soil did not contain enough alkali, even at Neosho Falls, to make it at all probable that this could have been the exciting cause of the disease. As is usual in the management of cattle at the West, the herds were without shelter. At Keith's the cattle lots were in a ravine protected by timber; on some of the farms there was little protection of any kind. Such a condition, however, is so common that it could not be regarded as having much influence in the production of this trouble. All of the affected herds seem to have received ordinarily good care. Keith had fed some of his cattle shelled corn and mowed oats in addition to hay. Pribbernow had fed his yearlings on millet, oats, and corn-fodder, and consequently they had eaten less hay. Beard had fed shucked corn. In Illinois, Keating had fed liberally on corn. On most of the farms the water was very good, but probably deficient during the cold weather. Keith had pumped water from his well; Goodrich's cattle drank from a pond; Beard's from the river, and Pribbernow's from a creek. It was necessary to cut holes through the ice and these would soon freeze over; consequently, it may be admitted that in most cases there might have been a deficiency of water.

When the animals first became lame it was supposed that mud had collected between the toes, and, becoming hard, was producing irritation. The animals were caught and their feet cleaned, but this had no effect on the development of the disease. It is evident that the animals were cared for as well as is ordinarily the case in this section of the country, and that the slight deficiency of water and the exposure to cold were accessory rather than the exciting cause of the disease.

SYMPTOMS AND CHARACTERS OF THE DISEASE.

The first symptoms of disease in the Illinois epizootic were diarrhea, lameness, stiffness of the lower joints of the affected limb, and coldness and insensibility of the same parts. In Kansas this derangement of the digestive apparatus was not noticed. At all the places visited, however, the lesions of the feet were of a common character and were produced by a common process. In the more severe cases a constricted band formed around the limb at the point separating the gangrenous from the living flesh. So marked was this constriction that some of the owners looked upon it as the initial lesion of the disease and cut across it with a knife in the hopes of re-establishing the circulation. It is needless to say that this hope was delusive, since the part below the constriction was entirely lifeless before this was formed. The constriction was the first step in the effort of nature to rid the body of parts that were of no further use to it.

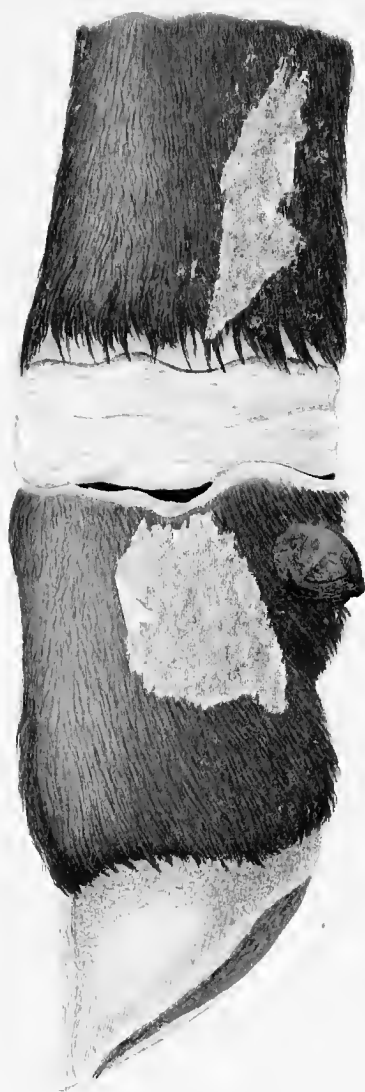
The next step in the process of separation was a crack in the skin at the upper edge of the band of constriction, which gradually extended toward the center of the limb, the softer parts dividing first and the tendons and ligaments resisting much longer. Generally this separa-

tion was in the vicinity of a joint, and in this case, as the lower members of the limb were lost a comparatively even surface was left which healed readily. Some animals lost only a toe, the dividing line passing through the joint between the *os pedis* and *os coronæ*; others lost both the *os pedis* and *os coronæ*; still others lost the three lower bones, and the line of separation passed through the fetlock joint, while in the most severe cases the line of constriction formed at the upper third of the metatarsal bone and the fleshy parts sloughed off, leaving the uncovered bone protruding for more than half its length. Plates V and VI are drawings made from limbs which I secured in Kansas.

It was reported by some of the veterinarians that small vesicles were formed in the interdigital space and about the coronet, and this was doubtless true, as such vesicles are not uncommon in gangrene; but their appearance was far from being the rule, as I did not succeed in finding a single one in all the animals that I examined. In nearly all of the cases, whether the foot was affected with dry gangrene or whether there had been simply lameness without death of the part, the skin of the interdigital space and about the coronet was perfectly preserved. There was loss of neither epidermis nor hair, as there certainly would have been had the disease commenced by a superficial inflammation in this region and extended to deeper parts of the foot or to higher parts of the limb. Indeed there were no abscesses, no burrowing of pus, no ulceration about the feet, which could lead one for a moment to suppose that the cause of the disease had commenced its action externally and extended gradually to the interior of the limb. On the other hand, the fact that the skin was intact in the great majority of cases, that the part was cold and insensible almost from the first, and that the line of separation passed entirely through the limb, removing one or more phalanges as completely as it could have been done with a knife, was sufficient evidence that the disease had an internal origin.

The gangrene was not confined to the feet, however, for in Kansas, Missouri, and Illinois there were individual animals which were losing from 2 to 6 inches of the lower part of the tail by exactly the same process. The portion below the dividing line was very dry and hard, while the line itself was sharply defined, as though it had been a knife-cut. With the greater part of the animals affected in the feet a careful examination of the end of the tail revealed a slough of greater or less extent; sometimes it was simply the skin at the tip that was affected, but oftener one-half inch, 1 inch or 2 inches would be found discolored, lifeless, and dry. In a very few cases a part of the ear was found in the same condition.

One of the most interesting features of the enzootic, because it had not been heretofore described, was the implication of the mucous membrane of the mouth. With some animals this was limited to a more or less diffuse red discoloration, without loss of substance. More frequently there were circumscribed dark red spots or patches, from a



Marx from Nature

A. J. Dent, Jr., from Dr. J. B. Moore

ERGOTISM (KANSAS)



fourth of an inch to an inch in diameter. Very often there was loss of substance—erosions from a third to a half inch in diameter. Some of the veterinarians reported that they had discovered blisters in the mouths, and it is not unlikely that these erosions in their first stages were more or less vesicular in character, but I was not fortunate enough to see them in this stage at any of the places visited. In some animals the part of the membrane that was being lost was still attached by shreds, in others it was entirely removed, but in no case did I see anything of the nature of a vesicle. None of the erosions presented the appearance of ulcers, or showed any considerable inflammation. They were dark-colored, the borders were not elevated, and the surrounding blood-vessels were neither prominent nor injected. It appeared to be only the superficial layer of the membrane that was interested.

In a very few animals a lesion of a different character was observed in the mouth. In these cases an irregular patch of mucous membrane from 1 to 2 inches in diameter was elevated, corrugated upon its surface, hard, insensible, and of a light color, tinged with pink and yellow. It seemed to be a circumscribed gangrene of the mucous membrane, the dead parts being partially decolorized by soaking in the fluids of the mouth.

There was also an evident irritation of the mucous membrane of the posterior parts of the alimentary canal and organs of generation. That covering the rectum and vagina was generally red, covered with mucus, and presented spots denuded of the epithelium. In Missouri six cases of abortion in cows were reported, and in Illinois there were many cases of abortion and difficult parturition with mares.

The constitutional symptoms were not very marked. The temperature of the animals which I examined was about normal, with the exception of a few from which one or more limbs were sloughing and with which there was suspicion of septic poisoning. Drs. Holcombe and Trumbower observed high temperatures (104 to 104.8 degrees) in some cases in the early stages of the affection.

In those animals which recovered after showing lameness there was no loss of substance or inflammation of the skin as would have resulted from freezing to a sufficient depth to cause lameness. In these animals the lameness and stiffness of the lower joints were the only symptoms of the disease in the feet, though the same animals frequently showed erosions in the mouths.

EVIDENCE POINTING TO ERGOT AS THE CAUSE.

In each of the herds which I visited, with the single exception of Beard's, there were typical cases of dry gangrene of the extremities, with an evident preference for the posterior limbs. In the most severe cases there was complete death of the leg as high as the middle portion of the metatarsal bone. This dead part was sharply defined, first by a constriction and later by a crack from the living flesh above.

It was not a death of the superficial structures alone, but the skin, tendons, and bone were all involved, and every part of the leg below the line of separation just referred to was completely lifeless. A study of these legs showed very clearly that the disease had not begun at the hoof or in the interdigital space and progressed upward, for these parts had not been changed by disease of any kind previous to the death of the whole affected part, which had evidently occurred very suddenly. To my mind this condition made it very plain that the trouble was not the result of any disease which had begun in the interdigital space, or in the skin around the coronet. There could be no mistaking the fact that the worst affected animals presented typical cases of dry gangrene, and the problem to be solved was to determine which of the conditions that these animals were subjected to would satisfactorily account for the enzoötic. When we turn to veterinary literature for information in regard to the accepted causes of dry gangrene, we learn that there are very few agencies which are liable to affect a number of animals at a time and are capable of producing this effect. Compression, burning, caustics, plugging of blood-vessels, and ergot about completes the list of those that would be at all likely to produce dry gangrene in young animals, and of these the last is the only one that could have possibly been instrumental in developing the outbreaks in the West.

The peculiarities of the disease led me to examine the feed to learn if any unusual quantity of ergot could be found. The result of this examination was to show that at every one of the farms where the diseased cattle were located, hay had been fed which contained one or more grasses ergotized to an extreme degree. At Keith's, Beard's, and Pribbernow's, in Kansas, there was a large proportion of wild rye (*Elymus virginicus*, variety *submuticus*) which contained an extraordinary quantity of ergot. In many heads half the grains and in other heads every grain had been replaced by the fungus. Careful weighings of heads brought to Washington, and from which some of the ergot had been lost in transit, gave in one case 12 per cent., and in another case 10 per cent., as the proportion of ergot. Now, if the head represented one-half the weight of the entire plant, from 5 to 6 per cent. of the weight of the rye must have been ergot; and if one-fifth of the weight of the hay was made up of wild rye, then a 20-pound ration of hay would contain about 4 ounces of ergot.

As is always the case where an attempt is made to account for results when the conditions affecting these have not been intelligently observed and carefully recorded at the time, we found some apparent discrepancies in the ergot theory. The greater part of these have been explained in a remarkably satisfactory manner, and if we could know every circumstance connected with the feeding and care of the animals for thirty or forty days preceding their illness, doubtless the most critical could be satisfied as to the cause of the disease in every subject. As we are compelled, however, to rely upon the more or less defective memories



Marx from Nature.

A. Hoen & Co. Lithographic Baltimore

ERGOT IN HAY.

of the owners of the cattle, who, of course, did not make their observations in the light of subsequent developments, we must accept the situation as we find it and consider ourselves fortunate if a connection can be traced between cause and effect in the greater part of the cases. An exact estimate could not be made of the quantity of ergot in a given quantity of the hay in Kansas, but the weight of ergot in the heads of wild rye indicated this very closely. The head shown in Plate VII, Figure 3, is a good representation of this plant as it existed in the hay.

In Missouri the hay was made up mostly of red top (*Agrostis vulgaris*), but also contained some blue grass and timothy. The red top and blue grass contained a very large proportion of ergoted grains, and an occasional head of timothy was also affected. Figures 1, 2, and 4, Plate VII, are drawings from specimens of these grasses taken from the hay-racks at which the diseased cattle were eating.

In Illinois the hay was almost entirely composed of red top, and this contained a relatively large amount of ergot. Careful weighings of specimens of this hay and the ergot which it contained, from two of the worst affected farms, demonstrate that every 75 pounds of hay contains 1 pound of ergot; or, in other words, an animal eating 20 pounds daily of this hay consumed 4.2 ounces of ergot. Doubtless this quantity might be taken daily for a considerable time without producing appreciable effects under some conditions, but when the circulation in the extremities is diminished by extremely cold weather, and when in addition to this the water supply is limited then ergot in this dose, continued day after day, becomes very dangerous.

In Kansas I examined the hay on adjoining farms where no disease had appeared, and I found a very much smaller proportion of ergot. At the Dibble farm, which joins Keith's, one might examine a dozen heads of rye without finding a grain of ergot, and the same was true of hay found in the town of Neosho Falls. In Illinois, at two farms, I saw hay of the crop of 1882 and also that of 1883, and while the former contained some ergot the latter contained a greatly increased proportion. It had been noticed by the people here that the red-top hay of the crop of 1883, for some unexplained reason, was greatly inferior; that animals neither relished it nor thrived when fed upon it, and it sold for \$3 a ton when other hay would bring \$10. At Keating's the animals fed on the hay of 1882 escaped the disease entirely, while those fed upon the hay harvested in 1883 alone suffered.

Evidently the year 1883 was a favorable one for the production of ergot over a very large area of the Western States, but the local conditions of soil and situation and the time of cutting the hay had a very great influence on its development. All of the ergoted hay of the affected farms in Kansas was cut from bottom lands, and in Missouri and Illinois it was grown on very level prairies the drainage of which was very imperfect. Again, the early cut hay was comparatively free, when that allowed to ripen was badly affected.

In brief, then, our reasons for considering the disease to be ergotism were, first, the character of the lesions, which were such as have always been ascribed to ergotism in the past, and as could scarcely be produced in so many animals from any other known cause; and, secondly, the extraordinary proportion of ergot found in the food of the animals on every affected farm.

It is very probable that the cold weather had a considerable influence in developing the effects of the ergot, and the greater part of the cases were first noticed during or soon after such weather. Many cases occurred soon after a severe ice storm or sleet. Again, with the appearance of milder weather new cases ceased to appear, although the same hay was still being fed. The two or three new cases in Missouri were the only exceptions to this statement.

I have no doubt, therefore, that the cases which I investigated, and the similar cases which occurred about the same time in other localities, were cases of ergotism. Professor Law, of Cornell University, Professor Stalker, of the Iowa Agricultural College, and Professor Faville, of the Colorado Agricultural College, have seen similar cases in their respective States, and concur in the opinion that they are due to poisoning from ergot.

CHARACTERS WHICH DISTINGUISH THIS DISEASE FROM EPIZOOTIC APHTHA, OR FOOT-AND-MOUTH DISEASE.

History.—The foot-and-mouth disease of Europe is a specific fever which only arises by contagion from other affected animals. In the whole history of America there have been no spontaneous outbreaks of this disease, and in Europe the conviction is growing stronger every year that it has no other cause than contagion. We may accept it, therefore, as a fact that foot-and-mouth disease cannot occur in the United States except by the introduction of virus from abroad.

When a disease having some resemblance in its symptoms to foot-and-mouth disease is found in the interior of our country, more than a thousand miles from the ports where the contagion must necessarily be introduced, it becomes a matter worthy of the most careful consideration to determine if there was any means by which this contagion could have been transported to the affected herd. When a contagious disease is spread broadcast over a country it may be difficult or impossible to trace many outbreaks; not so, however, with a single outbreak produced by so virulent a contagion as that of the disease under consideration. In such a case it would be remarkable if it could not be traced.

In the present instance the animals of the affected herds had been purchased or raised in the neighborhood; no foreign animals or people had been upon the farm where the first attacks occurred. Foreign cattle had for a long time been quarantined at the sea-board a sufficient time to make it impossible that this disease could have been carried by

them to the West. It was absolutely impossible to find any satisfactory manner by which a foreign contagion could have been introduced.

This important indication seems to have been greatly neglected in deciding upon the nature of the disease in Kansas. It was said if this is foot-and-mouth disease we must acknowledge that we have it, whether we can trace its introduction or not. Plausible as this reasoning may seem we must admit that it is not always an easy matter to diagnose a disease off-hand from its superficial characters. And in the diagnosis of contagious diseases we must remember that the symptoms are but the expression of the effects of the virus, and that these symptoms may be simulated more or less closely by other agencies acting upon the animal economy.

The history of the origin of any disease believed to be contagious is, then, a most important part of the evidence to be taken into consideration before a diagnosis is reached. We may take contagious pleuro-pneumonia for example. Many cases of this disease resemble so closely spontaneous inflammations of the respiratory organs in cattle that it is absolutely necessary before a diagnosis can be reached to inquire if the contagious pleuro-pneumonia has been introduced or if the malady occurred spontaneously. The same principle holds good to a greater or less extent with other diseases, and it may be safely asserted that when the history does not receive proper consideration many mistakes will be made that otherwise might be avoided.

Contagiousness.—The virus of foot-and-mouth disease is one of the most active contagions known. The period which elapses between exposure and the appearance of the first symptoms of the disease is, as a rule, but two or three days; a very large proportion of exposed animals become diseased, and the plague spreads rapidly from farm to farm. As a result of these characters, within a week after the introduction of foot-and-mouth disease into a herd nearly every animal in that herd shows unmistakable evidences of having contracted it. A very small proportion of the animals may resist the contagion, but this proportion is much less than with most other contagious diseases, and is so small that it does not affect the rule just mentioned.

The disease at Neosho Falls showed very different characters from this. Goodrich's herd suffered in the largest proportion, 65 out of 96, or 68 per cent., being more or less affected. The first case here occurred January 10, and no others until February 15, or more than a month later. After this new cases continued to develop for two or three weeks. But in a lot adjoining that in which the sick cattle were placed there were 20 calves, which remained entirely free from disease. The isolation of these calves was not sufficient to hold foot-and-mouth disease in check for a single day; it was even said that the sick cattle had been driven through the calf lot to water, and that some of the smaller ones, when attacked, were placed with the calves.

At Keith's 74 out of a total of 118, or 63 per cent., were affected.

At the end of the first week but 20 or 30 head had been attacked, and from this time new cases continued to appear until March, or during a period of two months. Here also it is to be remembered that in a lot of animals separated from the sick ones by a simple rail fence there was no appearance of disease until two months after it had attacked the first lot. Hogs were running in the lot with the worst cattle; they even ate the blood of the slaughtered ones and nibbled at the affected feet, but they did not suffer in the least. A sow had brought forth a litter of pigs in a shed which forms a part of the inclosure, and these were doing well. Two calves were sucking mothers under the influence of the disease but were themselves in good health.

At Pribbernow's only 8 per cent. of the animals had been attacked, and among a lot of 54 yearlings running with the other cattle there was not one case of disease.

At Beard's, in a herd of 75, the first animal was lame a week before the second was affected; and then another week passed before the others showed any symptoms. Here only 6 per cent. of the cattle on the farm were attacked, and one died within twenty hours from the appearance of the first symptoms.

At Kirksville the proportion of animals that suffered was not definitely ascertained, but there was no evidence of contagion, and sheep running with the affected cattle remained healthy.

In Illinois, on the Faunce farm, the horses suffered from an eruption in the mouth. The exact nature of this disease it was impossible to ascertain at the time of my visit. It may be remarked, however, that horses seldom suffer from foot-and-mouth disease; and that this is the only case which came under my notice on any of the affected farms where any other animals than cattle showed symptoms that were even suspected to be in any way connected with the disease among the cattle. In this instance the eruption in the horses' mouths could not have resembled foot-and-mouth disease very closely, for it remained at least six weeks, or three times the period of the latter disease. Here the neighbors' hogs which were running around the farm failed to contract any disease or to carry it to other farms.

At Mr. Mason's there was still more striking evidence to show that the disease was very different from epizootic aphtha. One hundred hogs and 40 sheep had been exposed, and not one suffered. Only 17 bovine animals out of 120, or about 15 per cent., showed any signs of the disease. At Keating's, 60 sheep and a number of hogs were exposed but all remained well. At Dubroc's, goats were exposed without suffering.

The disease, therefore, did not resemble foot-and-mouth disease either in the proportion of the animals attacked or its rate of extension, or in attacking other species of animals than cattle.

Occurrence at the same time on widely separated farms.—If foot-and-mouth disease had been introduced into the heart of the country in any of the extraordinary ways which were offered to explain its appearance,

we surely cannot conceive of its being brought to so many widely separated points at about the same time, especially where there had been no communication between these places. In Kansas there were the Keith, Goodrich, and Beard herds which might be grouped together; 14 miles from these was the Pribbernow herd; 20 miles from any of these was the cow at Hall's Summit; across another space of 15 miles was the O'Toole herd; then it was necessary to travel nearly 200 miles to reach the Osborne County cases. Again, the same disease undoubtedly existed at several points in Iowa, Illinois, and Missonri. There had been no communication between these places, and if we assumed that they were the result of a foreign contagion it was necessary to conclude that a considerable number of independent introductions of this had occurred at very nearly the same time. This assumption, in view of the difficulties in the way of introducing a contagion to the interior of the country, and the impossibility of tracing such introduction at this time, was so improbable that it could scarcely be admitted even if all other evidence had pointed to foot-and-mouth disease.

Comparison of symptoms.—The symptoms of foot-and-mouth disease are constitutional and local. The constitutional symptoms are loss of appetite, elevation of temperature, and other signs common to fevers. The local symptoms consist in an eruption of blisters in the month, between the toes, about the coronet, and on the udder and teats. In order to understand the difference in symptoms between the recent disease in the Western States and foot-and-mouth disease, it is necessary to examine each of those points separately.

The constitutional symptoms.—In foot and-mouth disease there is usually a very marked increase of temperature, reaching from 104° to 107° . At Neosho Falls the temperature, as a rule, did not exceed what might reasonably be expected in health. Some of the perfectly healthy yearlings had a temperature of 103° , while that of most of the sick ones was below this point. One of the steers in the early stages of disease at Keith's showed 104.4° on March 9, which was about the highest point reached by any. In foot-and-mouth disease there is loss of appetite and difficulty of swallowing, but here the universal testimony was that the appetite had remained good throughout and there was no trouble in mastication or swallowing. In Illinois there were marked symptoms of digestive disturbance, and the disease was ushered in by diarrhea.

The mouth symptoms.—In foot-and-mouth disease there is an eruption of blisters on the mucous membranes of the lips, gums, tongue, and palate, which are numerous and painful. Often they unite with each other and form large patches, from which the covering becomes detached, leaving ulcerous patches of a bright red color and of great sensitiveness. It is almost impossible for animals in this condition to eat hay or other dry food, and it is necessary to support them with gruel. Such animals stand, making a peculiar and rather loud smacking noise with the lips and tongue, grinding the teeth and salivating profusely. In Kansas the

month symptoms were much less severe than this, but two or three animals were reported to have had any salivation or any difficulty in eating hay. Some of the mouths presented erosions, which were mostly small, very superficial, and without any appearance of ulceration. I did not see a single blister, but a few of these were reported by those who visited the herds at an earlier date. The lesions which I saw in the months seemed to be due rather to a softening of the mucous membrane than to vesication; and I was assured that the appearances did not differ materially at the time of my visit from what they were when the veterinarians first saw them. In one or two animals there were large patches of thickened mucous membrane of a yellowish color, hard and difficult to detach. Healthy herds in the vicinity were visited, and in the mouths of these cattle were found discolorations and erosions very similar to, though less extensive than, those seen in the sick ones. In Missouri some of the cattle had the mouths involved to a greater degree than any I saw in Kansas, but others with equally bad feet had perfectly sound mouths. Here I saw pieces of mucous membrane becoming detached, but no blisters. Figures 1 and 2, Plate X, show the highly inflamed condition of the ulcers in the real foot-and-mouth disease.

The cattle in Illinois still had erosions in their mouths as late as April 24, which were identical in appearance with those I saw in Kansas. The steer which first came down with the disease on the Faunce farm, and which had consequently been affected about four months, showed these about as plainly as any animals I saw in Kansas. In foot-and-mouth disease the eruption disappears in from two to three weeks, and the animal is convalescent. Before proceeding to Kansas and Illinois the second time, I visited the herds at Portland, Me., which had been affected with foot-and-mouth disease. The contrast was very striking. Although the cattle in Maine had not showed the disease until the second week in February, they were on the 16th of April in apparently good health. There were no longer any sores in the mouths or on the feet. A week later than this I found cattle in Illinois that sickened in December and still had as marked mouth symptoms as could be found in any of the Western herds.

The feet symptoms.—The interdigital spaces and the coronet are the seat of the eruption in foot-and-mouth disease. Not only is there redness, heat, and swelling in these parts, but there is formation of blisters, loss of epithelium, and a secretion from the whole affected surface of the skin. The appearance of the feet with sheep and cattle having this disease is shown in Figs. 1, 2, and 3, Plate IX. Sometimes abscesses form beneath the horn, from which the pus may burrow and cause the loss of the hoofs, or even affect the ligaments and joints. But severe complications in the region of the foot do not occur except from this cause. With the cattle which I visited, the feet presented a very different appearance. Some of the limbs were separating, as a conse-

quence of dry gangrene, half way between the fetlock and hock joints, with the skin of the foot, still in perfect condition, though dead. In others the separation occurred at the fetlock, and in many others at the joints below, but not as a consequence of the burrowing of pus. Indeed, very little pus was to be seen in any of the feet. It is not rare to see the horn of one or both toes lost in foot-and-mouth disease, but it would be remarkable for the whole toe, including the bone, to slough off, as occurred so frequently here. I did not see a case where the hoof was lost without a loss of the bone at the same time. The complete death of the foot to the fetlock, or even higher, as occurred in all the worst cases in the West, is altogether unheard of in foot-and-mouth disease. While there was redness, heat, and swelling above the line of separation, I saw no appearance of blisters between the toes or around the coronet. A large proportion of the affected animals were simply lame, and had neither blisters nor sores about the feet. Finally, the disease was generally confined to the hind feet, or, if it attacked a forefoot, it was only after both hind ones were affected. Foot-and-mouth disease has no such decided preference for the posterior extremities.

The eruption on the udder.—In only one case that I have heard of in the West was there any appearance of an eruption on the udder of the affected cow. This was a cow belonging to Mr. Keith, the young calf of which died, as was supposed from the effects of the disease contracted from its mother. I am unable to account for the sores which evidently existed on the udder of this cow, not having seen her until they were nearly healed. There is also considerable doubt as to the cause of the calf's death. Certain it is that an eruption of blisters on the udder is an extremely common occurrence in foot-and-mouth disease (Fig. 3, Plate X). In the West, however, a considerable number of cows were affected, and but one had any symptoms of this kind.

Reviewing these symptoms, we can see that the disease which I investigated had few if any characters in common with foot-and-mouth disease. Among the whole number there was not a single animal which presented the typical characters of this plague. There did not appear to be a single animal which presented even the typical mouth symptoms, or the typical feet symptoms of that disease. The history, the characters, the symptoms, everything connected with the disease, led us to conclude, therefore, that it could not be the contagious foot-and-mouth disease.

CHARACTERS WHICH DISTINGUISH THIS DISEASE FROM FOUL-IN-THE-FOOT.

The disease known as foul-in-the-foot, and often called foot-rot, has its origin in the skin of the interdigital space. It begins as a superficial inflammation, which is followed by sloughing, ulceration, suppuration, the burrowing of pus, and the formation of sinuses. By this pro-

cess the disease may gradually extend beneath the horn of the toes and toward the deeper parts of the foot, until the tendons, bones, ligaments, and articulations are involved. In extreme cases it may even extend to or above the fetlock joint. Steel, in his new work on the "Diseases of the Ox," sums up this characteristic of the disease as follows:

Thus the pathological conditions of this disease are, at first, the existence of inflammation in the interdigital substance, which may be partially removed by sloughing, then the presence of pus beneath the hoof-horn, boring and forming simple sinuses, which extend outwards and burst on the surface. The patient is very lame, and the digits are separated from one another in a remarkable manner.

That is, foul begins between the toes, forms sores there, and these slowly extend by ulceration and the burrowing of pus. Neither in Kansas, Missouri, nor Illinois were any such pathological characters as these seen. There was sudden and complete death of a toe or of a foot, or in some cases of a leg as high as the hock joint; the disease showed no tendency to extend, but was limited by a groove around the limb, which soon became a crack, and the affected portion was sloughed off. There was no burrowing of pus, no ulceration, and when the lifeless portion of the limb had separated, the stump healed as readily as could be expected. The disease was dry gangrene beyond question, and dry gangrene is not produced by foul-in-the-foot.

Again, those who so confidently pronounced the disease to be foul, overlooked the gangrene of the tails, which was present in a large number of cases, and was most marked in those animals in which the feet were most severely affected.

Finally, the digestive disturbance and the lesions in the mouths were too evidently connected with the disease in the feet to be left entirely out of consideration.

It is surprising that two diseases having such different symptoms could be confounded, and the mistake of such a number of competent veterinarians can only be explained on the supposition that the examination was hurried and superficial, and that ergotism among animals has received but little attention in English-speaking countries.

OBJECTIONS WHICH HAVE BEEN URGED AGAINST THE THEORY OF ERGOTISM IN KANSAS.

When we first diagnosed the disease at Neosho Falls to be ergotism, we were met by the objection that ergotism could not occur without ergot in the food, and that this condition did not exist on the affected farms. It required but a few minutes inspection of the hay racks, however, to satisfy the most skeptical that the hay at Keith's, Beard's, and Pribbernow's contained a large quantity of ergot in the wild rye which made up a considerable proportion of the forage. And subsequent examination has proved its existence nearly everywhere that this disease occurred.

The second objection was that ergot did not produce dry gangrene in animals; and this statement has been repeated again and again by professional men who certainly ought to have known better. The quotations from standard authorities as to the effects of ergot and the historical compilation contained in other sections of this report will be sufficient, I believe, to satisfactorily dispose of these assertions.

Again, it was said that it required enormous quantities of ergot to produce appreciable effects on cattle, and even if it could in that case cause dry gangrene, the quantity found in the Kansas hay was totally insufficient to account for these results. To this I reply that ergot in different seasons is known to differ widely in its poisonous qualities; that certain conditions, such as extremely cold weather and deficiency of drinking water, undoubtedly increase its effects in a very important degree, and that, finally, we do not know how much is actually necessary to cause dry gangrene. Careful estimates of the quantity of ergot in the hay in Illinois, Missouri, and Kansas show that these cattle must have taken with their food from 3 to 4 ounces of this poison each day. The dose of ergot recommended by standard veterinary authorities as safe for medical purposes is about one ounce for grown animals, but it is not expected that this would be used for more than one or two days together. The diseased cattle, therefore, had taken from three to four full doses of ergot a day, and continued this for days and weeks. Considering that the action of ergot is to diminish the caliber of the blood-vessels, that the gangrene of the extremities is directly traceable to deficient blood supply, and that atmospheric cold also has a marked tendency in this direction; that, in addition to all this, the drinking places were frozen over, and the holes that were cut through the ice were only kept open a short time each day, it would appear that the conditions were very favorable for the development of ergot poisoning.

Then it was reported that the outbreak in Osborne County was certainly the same disease, and that the cattle had been pasturing on green rye and consequently could not get ergot. A few inquiries brought out the fact, however, that the rye pasture had only been in use for three weeks, while the disease had appeared at least six weeks previously. There was no reliable information as to what these cattle had been eating before the appearance of the disease, and the forage was not examined by any competent person.

"If this disease is due to ergot poison," says one gentleman, "why then is this the first outbreak, since the Kansas farmers have fed this same kind of hay to their cattle from the first settlement of the State?" But who knows that they have ever before fed hay containing as much ergot? In Europe the enzoötics of ergotism have at times been a century apart, and it is a well known fact that it is only in occasional years that these enormous quantities of ergot are produced. Then how can it be known that this is the first outbreak of the disease in Kansas? Cattle have frequently suffered with the same symptoms in New York,

Pennsylvania, Iowa, and Missouri, and why not also in Kansas? Who outside of the immediate vicinity of the suffering herds would have heard of the outbreak under consideration had it not been for the mistaken diagnosis that led the country to fear the presence of a dangerous contagious disease?

Again, would not this reasoning apply to any supposed cause of the disease as well as to ergot? No matter what produced the disease, if such an outbreak has never occurred before it might be said with just as much force, "Why, then, is this the first outbreak?"

"Again," the same gentleman goes on to say, "on Mr. Goodrich's farm, where the disease prevails, the lands are improved by cultivation, and there is no ergotized rye in his hay. Yet out of 96 cattle, 40 head of young stock are reported affected with the disease." This fact was the most troublesome of all I had to contend with in making my diagnosis, and I appreciated its importance perhaps as much as my critics could have appreciated it. The gentleman's statement is not absolutely correct, however, as there was a small quantity of ergoted rye in the hay; but still there was so much less than was seen at the other farms as to make it impossible to explain why the cattle here should be affected even to a greater degree than elsewhere. In my preliminary report I explained this by saying that wild rye was known to grow in patches, and that, consequently, hay that was being fed at one time could not be considered as exactly the same as that fed three months before. The apparent discrepancy in this case has since been explained, however, in a much more satisfactory manner. Some time last fall Mr. Goodrich bought two stacks of hay of Mr. Keith, and it was this hay that he had been feeding to his cattle up to the time of the outbreak of the disease. When this fact was learned the whole matter became perfectly clear, and what at first appeared the greatest objection to the ergot theory turned out to be one of its strongest supports.

Then Mr. Beard is mentioned as having fed 75 head of cattle all winter on hay full of ergot, and escaped with but 5 diseased animals. Mr. Beard, however, had fed his cattle twice a day on corn-fodder, that is, on corn which had been shocked but not husked, and as a natural consequence his cattle ate very much less of the hay.

"Stranger still for the ergot theory, Mr. Pribbernow fed 195 cattle on millet hay and corn-fodder, and he has 14 of his young stock affected." Here, again, the zeal of the gentleman to make out a case against the ergot theory has led him to make statements which are not correct. Mr. Pribbernow had some very badly ergoted hay, which he showed to me, and told me that he had been feeding it to his cattle; and, indeed, there was plenty of evidence that this was the case from the condition of the feeding yards and racks. It is a fact, however, that 54 yearlings were fed on millet hay, oats, and corn-fodder in addition to the hay, and that not one of these was affected. The older cattle had been fed more

exclusively on the hay, and it was among them alone that the effect of the ergot was seen. These facts I noted down as they were related to me on the spot by Mr. Pribbernow.

"Another puzzle is presented by Mr. Keith buying 63 head of young stock from Mr. Davis on the 15th of December, and on the 23d nearly all were down with the disease. Keith's hay contains ergotized rye. Davis has had no sickness in his herd." This statement is also very incorrect, and yet it contains a reference to the one unsolved difficulty connected with the Kansas outbreaks. The 63 head of cattle were purchased December 10, and as the first cases of sickness on this farm did not occur until the 23d or 24th, and as at the 1st of January there were still less than thirty cases all told on the farm, it is plain that these animals had sufficient time to contract the disease after their purchase.

The difficulty in regard to the ergot theory at Keith's was in connection with another lot of cattle bought about the 15th or 20th of December. This lot consisted of 6 yearlings and 2 cows, some of which Mr. Keith asserts were sick within three days and all within eight days, and that they were not fed upon hay during that time, but upon mowed oats and corn-fodder. He admitted, however, that there was probably hay in the racks to which they had access. There was much doubt as to the days on which these cattle were first seen to be lame, and as to how severely they were affected. It is also impossible to say, at this time, on what they had been fed previous to their purchase. This difficulty, however, does not compare with that felt at first in regard to the Goodrich herd, and as the latter was satisfactorily explained at the last minute, it is not at all improbable that there are some unknown facts in regard to the 8 cattle in question that would explain this case just as satisfactorily.

I have reviewed above the chief objections that have been advanced to show that the disease in Kansas could not be ergotism. It is unnecessary to add that they are mostly of the nature of captious criticism. The malady had been pronounced foot-and-mouth disease by some and foot-rot or foul by others, and these gentlemen found it desirable to make out at least an apparent case against ergotism. In other sections of this report I have given abundant evidence to show that it could be nothing but ergotism, and the plates herewith presented, which were carefully prepared by a competent artist, are sufficient to prove this beyond doubt to any one who understands the pathology of these different diseases.

THE NATURE, CHEMICAL COMPOSITION, AND ACTION OF ERGOT.

The substance known as ergot is one of the stages in the life history of a fungus which has been named *Claviceps purpurea*. The term ergot was applied to it by the French from its fancied resemblance to the spur of a cock. The place which this fungus occupies in the plan of nature

may be understood from the following table, which is taken principally from the classification proposed by Sachs :

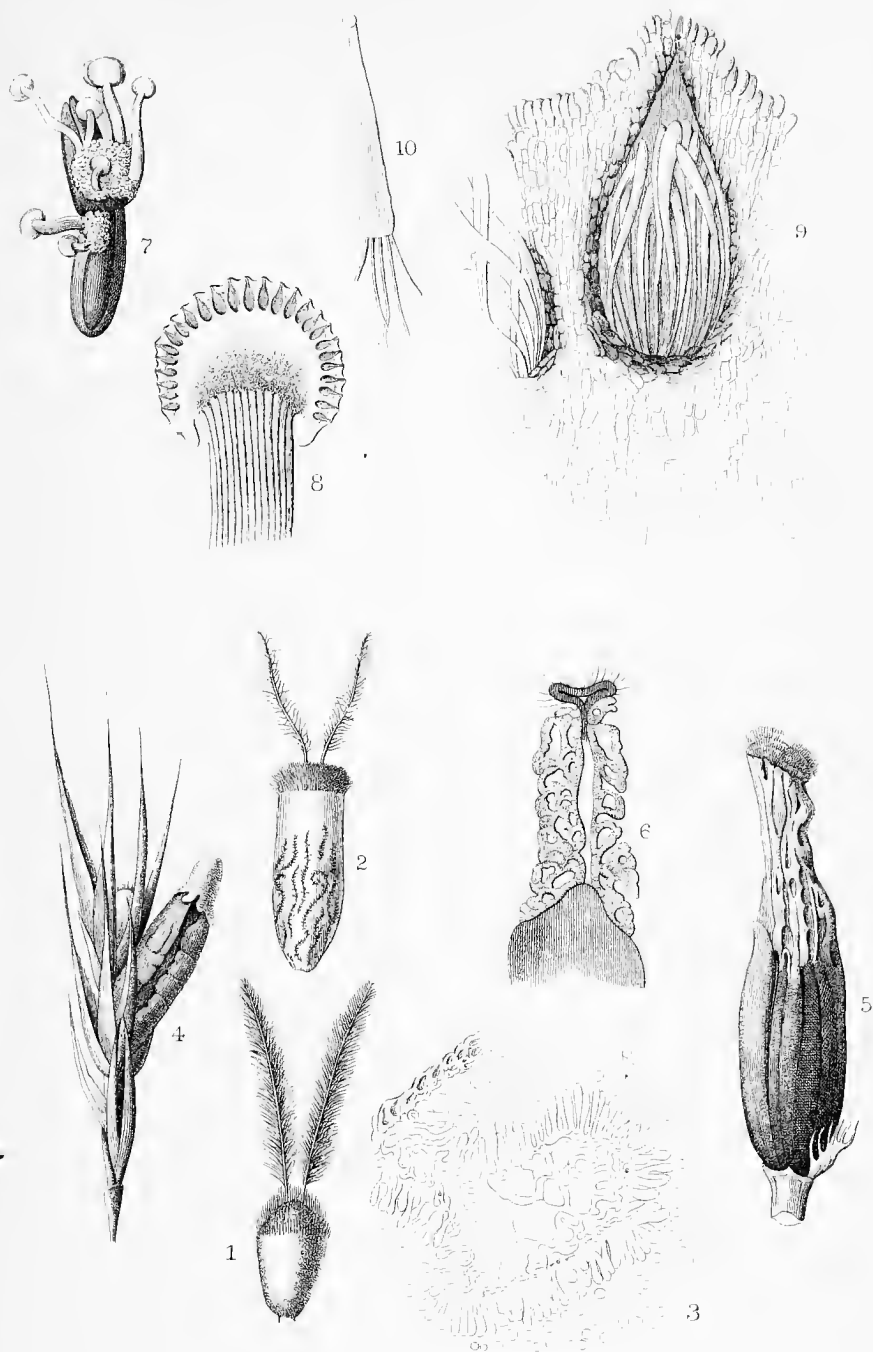
Vegetable Kingdom.	Group.	Class.	Order.		Family.	Genus
		<ul style="list-style-type: none"> Protophyta. Zygomycetes. Oosporeæ. Carposporeæ. 	<ul style="list-style-type: none"> { Containing Chlorophyll. { Without Chlorophyll. 		<ul style="list-style-type: none"> { Gymnascus. { Discomycetes. { Erisiphæ. { Tubercæ. { Pyrenomyces. { Lichens. 	<ul style="list-style-type: none"> { Claviceps. { Cordyceps. { Byssothecium. { Funago. { Pleospora. { Sphaerella. { Laboulbenia.
	<ul style="list-style-type: none"> Thallophytes. Muscinæ. Vascular Cryptogams. Phanerogams. 		<ul style="list-style-type: none"> { Ascomycetes. { Acidomyces. { Basidiomycetes. 			

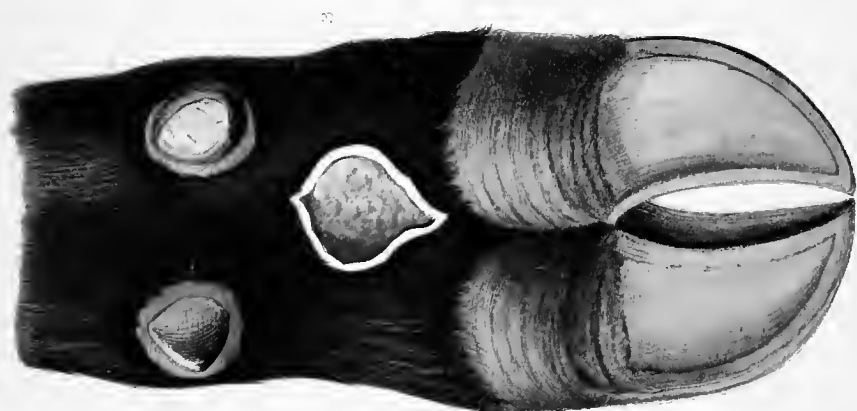
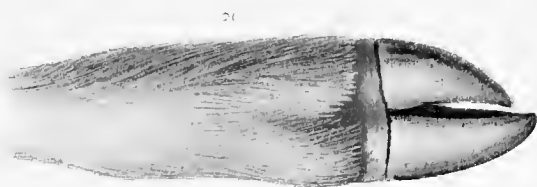
The growth of the claviceps begins by the germination of conidia or spores of this fungus, which have been carried by currents of air or other means to the flowers of the grasses favorable for its development. These conidia or spores, as the case may be, germinate in contact with the external surface of the ovary while this is still in an early stage of its growth, and form a mycelium which penetrates the walls of the ovary, and, as a rule, respects only the summit. It thus by degrees substitutes itself in place of the tissue of the ovary, and, consequently, preserves to a considerable extent the form of this organ. It bears on its summit the stigma, while its external coat is traversed by deep grooves and irregular cavities. (In Plate VIII, Fig. 1, is seen the normal ovary of the rye plant; Fig. 2 shows the same invaded by the claviceps.)

In this stage of its existence it has been called the sphacelia. As it develops it takes entire possession of the ovary, obliterating its cavity, and preventing the development of the ovule. The ovule may be either entirely absent or it may be present in an imperfect form, but does not develop into a seed. The mycelium produces at the surface of the ovary a large number of oval corpuseles, which are called conidia, and which falling upon other flowers may germinate and again produce the mycelium or sphacelia form of the fungus. (Pl. VIII, Fig. 3, which is a cross-section of the ovary, now called sphacelia, shows these conidia at its borders.)

The sphacelia, however, is not the ergot form of the fungus. At the base of this is produced a hard substance with a black or dark violet surface, and white or grayish within, which is the true ergot or sclerotium stage of the claviceps fungus. In the earliest period of the development of the sclerotium this is entirely covered by the sphacelia, but it gradually increases in size and pushes the sphacelia before it until the latter is raised entirely beyond the floral glumes, and is supported on its summit (Pl. VIII, Figs. 4, 5, 6). The sclerotium, or ergot, continues to increase in size and length, and the deformed ovary or sphacelia adheres to it for a long time, and may even be found in a considerable proportion of the specimens as seen in hay or mature grain after curing. In these the form of the stigma can be readily made out in most cases by the use of a low power lens.

Ergot is not therefore a diseased seed; on the contrary, it develops entirely below the ovary and prevents the formation of the seed. It is entirely a fungus growth, and is the resting stage of the organism. It







contains little or no starch, and its microscopical structure is that of the sclerotic mycelia. The sclerotium is looked upon as a hard compact mass of imperfectly developed mycelia. It appears to be about a month from the time the fungus invades the ovary until the ergot is fully formed.

The ergot is the dormant form of the fungus, and remains in this condition until autumn, or usually until the next spring. If at this time it is in contact with the damp ground it germinates and stromata grow from its surface (Pl. VIII, Fig. 7). These consist of a long stalk and a globular head, and become perfect fruiting fungi. In the head a large number of flask-shaped perithecia are formed (see Pl. VIII, Fig. 8), which are filled from the bottom with a number of asci (Pl. VIII, Fig. 9), each of which contains several slender filiform spores (Pl. VIII, Fig. 10).

When the spores reach the young flowers of rye, red top or other nearly allied grasses, they germinate and form a mycelium which invades the wall of the ovary and again produces a sphaecelia. With this the cycle of development of the fungus is completed and we probably have its entire life history. The meteorological conditions most favorable for the production of ergot are not well known. It has been asserted that it only appears in large quantities in rainy seasons, but others believe that moisture has little or no influence on its development. It is also uncertain whether more than one species of *claviceps* is concerned in the production of ergot in the different varieties of grasses. The ergot of the red-top hay in Missouri and Illinois produced identical effects with that in the wild rye of Kansas, and it would therefore appear that the physiological effects are substantially the same even though the species growing upon these two plants may be different.

The grains of ergot of rye are from half an inch to over an inch in length, and from one-fifteenth to one-sixth of an inch in diameter; they are nearly cylindrical, sometimes slightly ribbed and furrowed, and often have irregular fissures; they are curved, and taper toward the ends. The color of the surface varies from dark violet to blue black or black; the interior is white, often tinted with violet. The ergot of wild rye, blue grass, and red top has the same general appearance, but the grains are smaller. In red top many of the grains are so small that they are only recognized with difficulty by the unaided eye. Sometimes the taste is pronounced and disagreeable; but the ergot in the wild rye of Kansas, where the outbreaks of disease occurred, was almost or entirely without taste, and certainly was in no sense disagreeable when masticated.

Chemical composition.—Ergot is a very complex material when considered chemically, and although it has been studied by many competent chemists, there is yet much doubt as to the nature of a number of the substances which have been found in it. About 35 per cent. of its weight consists of a thick, fluid, fixed oil, which is now believed to be

ithout medical properties. Two non-crystallizable alkaloids have been described and called, respectively, *ecbolina* and *ergotina*; and one crystallizable which has been designated as *ergotinine*.

Sclerotic, *ergotic*, and *fuscosclerotinic* acids have been isolated. There is also a question of a peculiar ammoniacal base variously stated to be *methylamine*, *trimethylamine*, and *propylamia*. A mucilaginous substance called *scleromucin* and several other products of doubtful nature have been recognized. It has not yet been demonstrated which of these bodies constitutes the active principle of the drug, or whether the physiological effect may not be due to a number acting together.

The one point on which most of those who have studied ergot have agreed is that water extracts the medical properties, and this seems to be about the extent of our reliable information in regard to this department of the subject.

The action of ergot on the animal body.—The action of this poison in large doses is very clearly given in the following extract from Dr. H. C. Wood's *Treatise on Therapeutics, Materia Medica and Toxicology*:

According to Diez [quoted by Stille], the principal effects of poisonous doses of ergot are in the lower animals profuse salivation, vomiting, dilatation of the pupils, hurried breathing, frequent pulse, cries, trembling, staggering, paraplegia, sometimes diarrhea, sometimes constipation, prostration, urgent thirst, convulsions,* and death. Mr. Samuel A. Wright, in a series of experiments (*Edinburgh Med. and Surg. Journ.*, Oct., 1839, vol. lii), noted, when the medicine was given by the mouth, symptoms similar to those just spoken of; the paralysis was much more marked than the spasms. Late in the poisoning, the heart's action became irregular and intermittent, and the pulsations, which had been rapid, grew slow and feeble. In some cases the special senses seemed to be destroyed, and coldness of the surface was a very prominent symptom. Mr. Wright also injected a strong infusion of the drug directly into the torrent of the circulation. Death was in some cases produced in nine minutes, the symptoms being immediate dilatation of the pupils, great increase in the rate of the cardiac pulsations, paralysis, and convulsions. When the fatal result was not brought about in so short a space, great anæsthesia of the surface was noted a considerable time before death; coldness of the surface and paralysis of the special senses were also present in some cases. In Dr. Kersch's experiments (*Betz's Memor.*, vol. xviii), the concentrated infusion was injected into the jugular vein; the coldness of the surface was especially noted, and also great muscular rigidity. Upon rabbits, according to the researches of Wright, ergot acts very feebly. In birds, as represented by chickens, turkeys, and pigeons, it causes symptoms analogous to those produced in mammals, as is testified by Tessier and by Gross, both quoted by Stille, and by Bonjean (*Traité de l'Ergot de Seigle*, Paris, 1845.)

The above summary of the general symptoms caused by poisonous doses of ergot shows that the phenomena are mainly paralytic in their nature; but, although an enormous amount has been written about the drug, we have very little knowledge as to the immediate causes of the paralysis. Since both Wright (*loc. cit.*, pp. 320, 321) and Köhler have found that the voluntary muscles are not affected by ergot, it would seem that the nervous system must bear the brunt of the poison. Eugene Haudelin is said to have shown that the peripheral nerves are not affected, and the experiments of Köhler have confirmed this so far as concerns the motor nerves and the watery extract of ergot. He found, however, that those portions of the drug not soluble in

* Pereira states that convulsions were not present in the experiments of Diez.

water appeared to increase the excitability of the peripheral efferent nerves, and that upon the peripheral sensory nerves both portions of the ergot acted as a feeble depressant. On the whole, it is probable that the chief action of the drug is upon the nerve centers.

The following experiments of Tessier also indicate the active nature of the ergot poison (*Memoire sur les effets du seigle ergoté. Hist. Soc. Roy. de Med., 1777, 1778, Paris 1780, vol. ii, pp. 587-615*):

These experiments were instituted with hygienic precautions upon a number of animals. Of two ducks fed upon ergot, one, the female, died in nine or ten days. It had consumed one ounce and three drachms of ergot. There was a large violet spot on the beak, the covering epidermis was raised up by a collection of dark, fetid blood. The male died in fourteen days with the beak similarly affected; there was also drooping of one wing which showed two regions of inflammation, one in the fold and the other on the first phalanx. It had consumed 2 ounces and 6 drachms of ergot. A turkey was fed 8 ounces $4\frac{1}{2}$ drachms of ergot within twenty-two days. The autopsy revealed inflammation about the beak, but none of the feet and wings. A pig six weeks old died at the end of twenty-three days after receiving 1 pound and 12 ounces of ergot. The autopsy revealed swelling of the four feet especially at articulations, which were a reddish violet color. The ears were livid, there was gangrene of one side of the head and various internal inflammatory lesions. The articulations of the feet with the legs being uncovered there was seen, particularly with the posterior limbs, a thick, black, and fetid liquid. The animal previous to death had been able to support itself better on its fore than on its hind limbs. A six-months' old pig died after being fed during sixty-nine days upon a total of 22 pounds and 6 ounces of ergot. The autopsy revealed various internal inflammatory lesions, several violet spots on front and hind legs, the end of the tail dark violet, and ears livid. The two first phalanges of the right anterior foot were gangrenous and dry, especially near the articulations. The bones themselves were tinted brown. The same parts of the left foot were gangrenous but not so far advanced, as the bones were not altered. Upon each calcaneum there was a livid spot, larger on one than on the other. During life there was on the twentieth day a purulent discharge from two cavities in the articulation of the right foot; these were soon covered with a crust. The limb remained cold. On the forty-second day the corresponding joint of the left anterior leg developed a tumor which by the fifty-eighth day became an open sore. Both legs were cold and swollen, dry, insensible, and portions of the muscles became detached. The animal was no longer able to walk.

Salerne, cited by Read, gave to a small male pig barley mixed with half its weight of ergot. At the end of fifteen days the legs became red, secreted a yellowish and fetid humor, the skin of the back and beneath the abdomen became black in color. This food was continued for fifteen

days and then replaced by some free from ergot. The animal died four days later; there was no gangrene of the feet. Read fed a pig three months old for fifteen days with ergoted wheat mixed with bran. Gangrene seized the left ear on the seventeenth day and it dropped off. The pig died two days later with convulsions. A gangrenous spot was found on the liver. (A. Tardy. *De l'Ergotism*, Paris, 1858.)

Fleming, in his *Mannual of Veteriuary Sanitary Science and Police*, (Vol. I, p. 65), says: "The ergot on rye, wheat, &c., has also given rise to extensive disease in man and animals, including birds, marked by convulsions, paralysis, dry gangrene of the limbs, loss of hair and horn, and other strange phenomena."

M. Tabourin, in his *Nouveau Traité de Matière Médicale de Thérapeutique et de Pharmacie Vétérinaires*, Paris, 1866, gives the following description of the action of ergot (pp. 448 to 450):

The effects of ergot of rye should be divided into medicinal and toxic.

Medicinal effects.—The action that ergot of rye exercises on the natural surfaces and on the denuded tissues has been very little studied with animals, but appears to be slightly irritating; with man it has been noticed that the aqueous extract arrests capillary hemorrhages with considerable rapidity, and that it has a manifestly astringent action on denuded tissues. In the digestive tube the effects are but little marked when the medicine is given in small doses; it is only when the quantities ingested are considerable that vomiting occurs with carnivora and a serious irritation of the intestines with all animals. In regard to the dynamic or general effects produced by the ergot of rye in medicinal doses, when its active principles have been absorbed, they are almost unnoticeable with healthy animals and have been only very imperfectly studied up to this time. It follows, however, from the trials undertaken by various authors on the greater part of the domestic animals, that this medicine produces with them as with man two effects somewhat opposed to each other: a very pronounced sedative action on the circulatory center, and an energetic stimulation of the nervous centers and particularly of the posterior portion of the spinal cord. We will return to these two culminating effects of ergot of rye in connection with the toxic action that it has on the organism which we are now about to study.

Toxic effects.—The poisoning of animals by ergot of rye is called ergotism. It may occur at the end of a longer or shorter time, according to various circumstances and particularly according as the ergot is given alone or mixed with the food. In the former case, it occurs after a few days with birds, and after weeks or even months with mammals, according to the size of the doses and the time between them. In the second case it is much slower still, and when its existence is manifested by apparent phenomena the destruction of the organism is already consummated and there is no means of providing a remedy for it. This is a remarkable example of chronic or slow poisoning.

The characteristic signs of ergotism are of two varieties. One of these is due to the narcotico-acrid and exciting action that the ergot exercises on the nerve centers; the other is due to the sedative action that it produces on the heart. When the former predominates, as has been observed with certain epidemics with the human species, the ergotism is called convulsive; when, on the contrary, the second is more pronounced the ergotism is called gangrenous. It is difficult to establish this distinction with animals where the signs of the two varieties are mixed in nearly equal proportion as we shall demonstrate.

1. *Solipeds.*—Of all the domestic animals, the solipeds are the least exposed to poisoning by ergot of rye, because oats, the grain they receive most often, is rarely affected with this alteration. Only two authors, MM. Hertwig and Parola, have made experi-

ments on solipeds with ergot of rye. The former administered three and one-half kilograms (7.7 pounds) of this substance to a horse in the space of 24 days; he observed some nervous phenomena and a great depression of the circulation, but no appearance of gangrene. The latter gave ergot of rye to a mule, affected with chronic coryza, for six days in the dose of one to two ounces a day. There was slowing of the circulation, decreased temperature of the body, difficulty of respiration, loss of appetite and strength, general depression, muscular trembling, slight swelling of the knees toward the end, &c. The subject was destroyed. The discharge from the nose had disappeared.

2. *Large ruminants*.—Poisoning of large ruminants by ergot is more common than that of solipeds because these animals receive quite often, as a supplementary ration, the rejected grains coming from the thrasher or from screening, which always contain more or less ergot of rye and of other grains. With the large ruminants the convulsive phenomena are not seen or are not very apparent; but the depressive effects on the circulatory system are, on the contrary, very marked. Besides, the health is maintained without serious disturbance during weeks and even months if the ergot is taken with the food. Only the extremities lose little by little their natural warmth, as is noticed with the ears, the tail, the lower part of the limbs, &c. The digital region, and sometimes even the metacarpal and metatarsal regions, as M. Decoste has observed, are smitten with dry gangrene. In this case, the parts lose their warmth, their sensibility, become hardened and mummified, and soon separate without pain from the parts which have still remained living.

3. *Small ruminants*.—It is known that the sheep may, like other animals, feel the noxious influence of ergot; but science is wanting in precise documents concerning this ruminant and the goat.

4. *Pigs*.—It follows from some experiments made on these animals by Tessier, that ergot of rye poisons them after a greater or less time according to their force of resistance. There is seen in the first place vertigo, unsteadiness in standing, a tottering walk, moaning, swelling of the eyes, &c.; then the ears, the tail, the lower part of the limbs, lose their warmth and vitality; soon appear livid spots, which afterward become black and gangrenous, and are the beginning point for the separation of the mortified from the living parts.

5. *Dogs*.—M. Dien has given ergot of rye to dogs in the dose of 15 grams (half an ounce) a day. The animals were soon taken with nausea, bloody diarrhea, a nasal discharge also colored with blood, depression, weakness, and soon drop into a frightful marasmus. The experiments not having been pressed to the end, the phenomena of dry gangrene could not be observed.

6. *Fowls*.—These little animals are most exposed to the poisoning under consideration, because they often receive for nourishment the residue from cleaning grain which always contains more or less ergot. The first signs of this poisoning are loss of liveliness, indifference to surroundings, and great dullness; then there is vertigo, drooping of the wings, &c.; finally appear more characteristic signs—a bloody discharge from the nostrils is seen; the crest becomes black, shrunken, and mummified; the beak dries and is detached; the same course is soon followed by the tongue; the feathers lose their luster and fall out. Death results soon after these symptoms are seen.

To recapitulate, the most ordinary signs of ergotism with the various animals are as follows: Dullness, fixed expression, vertigo, dilated pupils, intoxication, coma; in the beginning muscular tremblings, then convulsive shocks, tetanic attacks, particularly in the posterior members which afterward become weak and paralyzed, unsteady position while standing, slow and difficult walk, &c.; general weakness, progressive emaciation; pulse slow and weak, skin cold; hair dull, limbs, ears, horns, and tail lose their natural warmth; sero-mucous and sometimes bloody discharge from the nostrils, cold swelling of the limbs; black spots, livid patches, gangrenous sores; dry gangrene of the crest, of the beak and of the tongue of birds, and of the

ears, the tail, the phalanges, the limbs, which become detached little by little and piece by piece from the trunk without inflammation or pain, &c.

Lesions.—The digestive tube is more or less intensely irritated, the viscera are flabby and softened, the muscles semi-gelatinous, the blood fluid, violet colored, the interior of the vessels red as in putrid diseases &c.

M. Verheyen, in his article on ergotism in the *Nouveau Dictionnaire pratique de Médecine, de Chirurgie et d'Hygiène Vétérinaires*, gives the following account of the effects of this poison:

Symptomatology.—In spite of the numerous experimental studies of which the ergot of rye has been the object, its effects on the organism are far from being sufficiently understood to enable us to write in a complete and connected manner the part of the medical history of ergotism relating to the symptomatology and pathological anatomy. The mode of action of ergot on the economy is only presented so far in a fragmentary state; the acquired knowledge does not permit the tracing of a physiological chart of all the phenomena produced by this agent. A large number of experimenters, particularly among the modern ones, have only produced an acute intoxication, of rapid progress, which leaves in obscurity the evolution, the gradation, and the succession of the morbid phenomena; in a word the progress of natural ergotism resulting from the introduction into the economy of small but long continued doses of the toxic substance. History mentions destructive epidemics, and others which have been relatively mild; this difference can only be due to predisposition and to the abundance of ergot. Rye is rich in it in the calamitous years; the high price of cereals, and of all kinds of provisions, prevents the poorer classes from procuring sufficiently nutritious food. There, consequently, follows a constitutional debility and anemia, which singularly favors gangrenous and convulsive disorders. The observation, so precise, of M. Decoste, as regards the hygienic diet to which the cow, which was the subject of it, had been submitted, the conditions under which the epizootic of the State of New York appeared, proves that misery constitutes a predisposing cause not less energetic for animals than for man. The experimenters have not taken into account these constitutional modifications which increase the susceptibility to the poisonous agent, and give to ergotism a new symptomatic expression. Here, it appears to us, is found the key to the numerous contradictions that are noticed when the experiments are compared with each other. To cite only a single example concerning the bovine species, we see that Riemann did not succeed at the end of eight days in provoking the least abnormal phenomenon, and that Wahlin produced no other noticeable symptom than constipation. The authors who have observed cases of ergotism with animals during the course of an epidemic may be correct when they mention the fact very summarily, and limit themselves to a statement that the phenomena were absolutely similar to those presented by man. This identity justifies, to a certain extent, their laconism, and the epidemic conditions explain the differences obtained by experimenting during the epidemic periods and out of these periods. During the epidemics the rule relative to the gangrenous form in the south and the convulsive in the north is applicable to artificial ergotism. A final remark, perfectly justified, and which has been little if at all considered by the experimenters: Tessier, who brought a high order of intelligence to the elucidation of the history of ergotism, asserts that all animals show a very great repugnance to take ergot voluntarily; this is so insurmountable for some individuals that they will die of hunger rather than touch it. Consequently all were far from being assured that the ergot offered was really consumed.

Having made these observations, let us take up the symptomatology of ergotism—they will excuse the incomplete sketch that we trace.

These morbid phenomena are very inconstant during the period of invasion. Sometimes they indicate a lesion of the cerebro-spinal apparatus, at other times the digestive tube is invaded, at still other times the symptoms proceed from the circulatory

system. This variability is common with fowls, with pigs, and with carnivora. The predominance of the cerebro-spinal affection manifests itself in various degrees of intensity; it may be arrested after development when the exciting cause, the alimentary use of ergot of rye, has ceased. In the first place, there is vertigo; the animals stumble as if they were intoxicated; they lose their equilibrium, fall on the side, and remain in a state of drowsiness, which is not dissipated even when they arise. The hair and feathers lose their luster; the temperature of the skin is lowered; there is anæsthesia, the insensibility following a condition of hyperæsthesia; this alternation affects also the sight and the hearing (Wright). It is unmistakable in the canine species; the pupils are constantly dilated. The symptoms of narcotism that we have just enumerated persist or are interrupted by convulsive phenomena, sometimes of the limbs only, and sometimes of the whole body. The general convulsions are characterized by tetanic epileptic attacks usually followed by temporary paralysis of the posterior parts. The suffering is sometimes so intense that it is manifested by plaintive cries and contortions. The nervous attack over, the animal falls again into a condition of apathy or drowsiness. If the spasm is limited to the limbs, there remains after the attack a contraction which persists for a certain length of time.

These phenomena which characterize spasmodic ergotism have an indefinite duration. Death may occur after a few hours or a few days as a result of a paroxysm, or the disease may be more prolonged and take a chronic form. The nutrition suffers; the animals become thin in spite of the appetite, which, however, is irregular, and finally a convulsion at last destroys them in an advanced condition of marasmus. The circulation is abnormal, the pulse is slow, accelerated but afterwards retarded; the arterial and cardiac contractions are spasmodic.

The participation of the digestive tube, which may be either the principal or the accessory cause of the cerebro-spinal affection, is announced by nausea, pharyngeal spasms, vomiting, diarrhea, sometimes followed by an insatiable hunger. If this is satisfied the food does not alleviate the hunger, for it causes convulsions. In the south all these symptoms may be preceded by gangrenous accidents; the latter may also precede when the circulatory lesion is the first to occur. With the gallinaceans the crest becomes cold, takes a violet or black color, shrivels, and dries; these phenomena are also quite constant in the north, but the dessication of the beak, sometimes of the feet, constitutes an alteration exclusive to the south; gangrenous patches also cover the abdominal walls (Millet). In gangrenous ergotism of the palmipeds, besides the beak, there is sometimes seen mortification of the point of the tongue (Tessier), and of the interdigital membrane which is discolored and becomes dry and brittle; then the digits are lost (Decoste). With mammals the gangrene attacks the lower part of one or several limbs, the ears or the tail; these parts become red as if they were the seat of an erysipelatous inflammation; the color changes to violet, to blue, or to black; they become mummified and detached when the convulsive paroxysm has not destroyed life before the completion of the work of elimination. While this is occurring the loss of flesh progresses and marasmus comes on, then, finally, a convulsive movement which destroys the patient. The mummification also attacks isolated muscles and in very exceptional cases the dry form of gangrene is associated with the humid form (Tessier). The pulse remains small, feeble, slow, or indeed it becomes accelerated, febrile, and precipitates marasmus.

Sheep which are subject to convulsive ergotism, are probably also subject to the gangrenous form. We have abstained from considering it in the symptomatology because we have not met with documents which authorize us to generalize the symptoms and to extend them to the ovine species.

The gangrenous form is the only one which has been observed with the bovine species; it remains local and is not complicated with the greater part of the general symptoms which may precede it with the other species of the domestic animals that have just been referred to. The appetite is preserved, the muzzle remains moist, and the expression of the eye is not changed. These signs of health often remain

until the fatal termination of the disease. The circulatory lesion seems then to be alone in play; it is localized in the digital region of the posterior limbs (Randall), or extends to the metacarpal and metatarsal regions of the limbs of one side (Decoste). A slight swelling of these parts announces the beginning. The hair becomes dull, the skin is dried, hardened, and mummified as well as the parts immediately beneath it. The appetite is preserved, but the animals become thin; a few individuals take flesh after the loss of the gangrenous limbs and may be prepared for the butcher. Death in a condition of marasmus is the most common result. When the affection takes a relatively benign form the gangrene does not destroy the part; the digital region loses its elasticity, the points of the toes are elevated, grow to an unusual length, and the weight is supported on the back of the fetlock. In this situation the animals pass a miserable existence until the owner, from pity, sends them to the butcher (Randall). The more benign form seems to us to have a resemblance to convulsive ergotism; the position of the posterior limbs has perhaps for its origin a contraction of the extensors.

In the records of epidemics of ergotism there are found but few references to the disease in the horse, and these are of no use in tracing the symptomatology. We are then reduced to a recapitulation of experiments to the number of two, one made by Hertwig and the other by Parola.

Hertwig administered to a horse within twenty-four days 3,552 grams [about 7 pounds] of ergot of rye. The phenomena observed were slight colics, loss of appetite, which disappeared within a few hours, drowsiness, which also soon passed away, dilation of the pupils, slight spasmodic contractions of the muscles of the skin and diminished temperature of the surface of the body. The pulsations of the arteries were retarded from 40 to 28 to the minute. The day following the administration of the last dose all abnormal phenomena had disappeared.

Parola experimented on a vigorous and lively mule affected with a nasal discharge. During six days he gave it, in addition to its ordinary ration, ergot of rye in progressive doses of from 20 to 64 grams [$\frac{3}{4}$ to 2 ounces] a day. The first day, the pulse was from 56 to 58, with lowering of the external temperature. The second day, pulse 58, respiration difficult, tearful eyes, loss of appetite, dullness, beating of heart insensible. The third day, coldness of the skin, general tremors, difficult respiration, spasmodic trouble of the cardiac and arterial pulsations, absence of appetite, apathy, dullness, suppression of the nasal discharge, which returned after the use of irritating injections. From the fourth to the seventh day, development of these symptoms, unsteady and difficult walk, trembling, inclined to lie, painful swelling of the knees, the nasal discharge definitely arrested. After having taken in all 284 grams [0.6 pounds] of ergot, the mule, which had continually lost in flesh and liveliness, became insensible and was destroyed.

It may be concluded from these facts that the horse escapes the pernicious effects of ergot no more than other animals, and that, placed under favorable conditions, one of the two forms of the disease may be clearly manifested, as the result of long and continued use. Ergot is also a poison for insects; in Poland they kill flies by giving as a bait powder of ergot mixed with honey. Leeches, plunged into an infusion of ergot, perish instantly (Lorinser).

Anatomical characters.—Studied for centuries, ergotism presents, in regard to its pathological anatomy, lamentable deficiencies as well with mankind as with animals. Considering the variation of symptoms it is useless to insist that the anatomical lesions cannot in all cases be the same. Those which we are about to enumerate all belong to either artificial or experimental ergotism.

The *rigor mortis* is never excessive; the flabby muscles are softened, the bones engorged with blood, particularly near the articulations. The venous system is distended by a black, pitchy, semi-fluid blood; the arteries, sometimes empty, contain in other circumstances a red fluid blood. In the thoracic cavity the lungs are found hepatized in the posterior portion; the heart flabby, small or voluminous, contains

fibrous coagula and a black, viscid, semi-fluid blood; in the left side of the heart, which is often empty, there is nothing found but fibrinous concretions. The mucous membrane of the small intestine is pale, yellowish, infiltrated, and softened, sometimes covered with red striæ or black points. These black points are compounds of fat and pigment (T. O. Hensinger). The mucous membrane of the large intestine shows hyperæmia, which is far from being constant. The proventriculus of the gallinaceans has a gray or a wine-red appearance; its mucous membrane is ulcerated or covered with granulations; the gizzard is black (Millet). Do not the granulations depend upon the ulceration of the pepsine glands? The cerebral envelopes, principally at the base, are congested, engorged with a black blood resembling that found in the veins; a section of the brain shows sometimes a very apparent punctation; in other cases, much more common, it is anæmic. Analogous changes are met with in the spinal cord.

The local disorders of gangrenous ergotism are those of dry gangrene (see *Gangrene*).

Physiological action.—The symptoms of gangrenous or convulsive ergotism, as a whole, indicate incontestably that the nervous system fills the principal rôle. The phenomena observed by Hoppe when he placed ergotine in contact with the isolated organs of the frog or the rabbit would remove all doubt if any could exist. Ergotine causes a marked stimulation of the heart, followed by a weakening and a retardation of its movements; the intestine contracts, but the contraction is not renewed after a second application; the blood vessels dilate; soon follows a contraction with congestion of the *vasa vasorum* which swell and cause the walls of the veins and arteries to become rigid; the sensitive nerves are partially paralyzed; later their sensibility is increased; a general intoxication congests the brain and spinal cord. This last effect is not constant; the autopsies show that though the envelopes of the cerebro-spinal axis are always congested, wholly or in part, the nervous centers themselves are quite often anæmic.

It follows from these results which are conformable to what is observed in ergotism that the primitive phenomena depend upon a sedation of the sensory nervous system, and this anæsthesia is succeeded by a hyperæsthesia and a retardation of the circulation. The exaltation of the sensibility has not always the same seat; this circumstance explains the variations of the symptoms and the predominant lesions of a functional apparatus. In all cases the hyperæsthesia excites reflex action, sometimes in the intestinal tube (colic, vomiting, and diarrhea); at other times in the voluntary muscles (contractions and convulsions); at still other times in the involuntary muscles of the vessels (gangrene). These reflex actions may be successive, simultaneous, or they are developed separately and remain separated during the whole course of the disease. With man, who can give an account of his subjective sensations, intense pain precedes the contraction; then follows, according to the intensity of the disease, convulsions varying from trembling to epileptic attacks. The over stimulation leads to exhaustion, which brings a calm in the sensitive system. Intolerable pains, which are more localized, also precede the dry gangrene; the patient feels in the part which becomes the seat of it a cold sensation; later, this is recognized by the thermometer and to the patient it seems glacial; the sensation is lost when the gangrenous effect is accomplished. The dilatation of the vessels, followed by a narrowing of their channels are phenomena which are connected with primitive anæsthesia, a secondary hyperæsthesia, and with reflex action, which affect the vaso-motor nerves. The rigidity and congestion of the vascular tubes, the weakening of the contraction of the heart, retard the circulation in the extremities, favor the stagnation of the blood, and consequently necrosis, even if the reflex phenomena are not sufficiently intense to obliterate the channel of the afferent vessel and produce mortification by anæmia. What is produced in an intense manner at one or several extremities is repeated at all the periphery in gangrenous and convulsive ergotism; the lowering of the temperature has no other cause than the retardation of the circulation and the reflex muscular

spasm. The cerebral phenomena are probably only secondary and are due to the congestion of the brain and its envelopes; the anæmia of this organ would also account for them. It is a law that local congestions go side by side with local anæmia; when ergotism becomes chronic, the anæmia is generalized, a common result in all diseases which are of long duration. The absence of exudations removes all idea of inflammation, and if hepatization of the posterior lobes of the lungs has been found, particularly with the gallinaceans, this lesion is neither constant nor general.

The medium dose of this agent for medicinal purposes is given by Tabourin (*Nouveau Traité de Nat. Méd., etc., II, p. 447*) as follows: Cattle and horses, one-half to one ounce (16 to 32 grams); goats, sheep, and pigs, one to two drachms (4 to 8 grams); dogs and cats, one-half to one drachm (2 to 4 grams). Finley Dun says: As a parturient or styptic, for the mare or cow, one-half to one ounce; for sheep, swine, and bitches, about one drachm (*Vet. Medicine, p. 212*).

HISTORY OF ERGOTISM.

Wood states that epidemics of ergotism or chronic ergotic poisoning have been recorded from time to time since the days of Galen [130 to 200, A. D.] and of Cæsar [B. C., 100 to 44]. (*Therap. Mat. Med. and Tox., 4th ed., p. 565.*) There is much reason for doubt, however, in regard to the diagnosis of cases occurring before the tenth century.

Verheyen says that, "From the ninth to the thirteenth centuries several grave epidemics appeared in France. The first chroniclers who made mention of them, faithful to their traditional habit, confounded them under the generic denomination of *plague* (*peste*). In the tenth century these epidemics received a special name; they were called *ignis sacer, arsura, claudes seu pestis igniaria*. In the twelfth century the nomenclature was increased with the terms *ignis sancti Antonii, sancti Martialis, Beato Virginis, ignis invisibilis, seu infernalis*. All these expressions were used to designate one and the same affection, which was no other than ergotism.

The learned historian of the epidemics of *feu sacré* of the Middle Ages, Professor Fuchs (*Das heilige Feuer im Mittelalter*, Berlin, 1834), fixes the first invasion in the year 857. This explicit passage of the chronicle leaves no doubt in this regard. *Plaga magna vesicarum turgentium grassatur in populo et detestabili eos putredine consumsit, ita ut membra dissoluta ante mortem deciderunt.* (Pertz, 11, 230.) The epidemic of 590 (Greg. Tur., X, 30) that some authors refer to the *feu sacré*, does not appear to us to have presented the characters of this. Its course was extraordinarily rapid; it began with a slight headache, a forerunner of death (*ita ut modico quisquis ægrotus capitis dolore, pulsatus, animam funderet*). These morbid characters can no more be considered ergotism than the very vague statement that near Limoges several were consumed by the *feu celeste* with which some were burned in Touraine (*nonnulli ab hoc igne sunt adusti*). At the same time a very fatal epizootic occurred which did not spare the deer. A great drought had destroyed the herbage; it followed rains and inundations, conditions favorable to the evolution of charbonnous diseases. A fact supporting this view, as well as the opinion of Fuchs, is that rye, which is an Asiatic plant, was only introduced into cultivation during the Middle Ages (Link). Admitting, what is supposed, that Europe is indebted for it to the invasion of the Huns, it is still very necessary to take into account the condition of this part of the world before concluding that at the end of the sixth century the new cereal had become generalized and had entered into the regular agricultural rotation of Gaul.

All the epidemics of *feu sacré* correspond to years which were characterized by a rigorous winter followed by a very rainy summer, causing a deficiency in the harvests, and bringing scarcity and famine. The epidemics began about the month of September or October and terminated in the spring, unless the atmospheric condition of the

following year continued to be fatal to the products of the earth. No mention is made of great epidemics of *feu sacré* during years which were characterized by productiveness, but local epidemics are met with which were circumscribed within the limits where the center of ergotism still exists in our days, and which comprises *la Sologne, le Dauphiné, le Lyonnaise, la Lorraine, and l'Artois*.

If we take into account the conditions which concur in the evolution of *feu sacré*, it may be established, *a priori*, that the sanitary state of the domestic animals was not more favorable than that of the human species, and that epizootics should have been more frequent than they are mentioned by the chroniclers. Are indications found in their annals which authorize us to attribute these epizootics to the same source, that is, to the *feu sacré*? This question cannot be solved; more than that, the accounts themselves forbid an hypothesis relative to the form and nature of simultaneous diseases. It is sufficient to cite this passage from the chronicle of St. Bayon, referring to the year 1127: *Plaga divina Franciam effligit, ignis scilicet corpora crucians. Pestilentia maxima facta est animalium*. What was this plague of animals? Formulated in this manner it is impossible to conjecture. If in the presence of such profound obscurities we are permitted to hazard an opinion, we would say that in all probability the food of the animals did not consist of rye in these calamitous years when scarcity and famine were general, and when the cause of *feu sacré* was unknown. Removed from the toxic factor, they did not escape its powerful accessories, and the diseases which decimated the herds must have been other than ergotism.* Perhaps the first epidemic of *feu sacré* which ravaged Portugal in 1189 was an exception, and it may be necessary to attribute the concomitant epizootic to ergotism. It is thus described: *Hujus etiam tempore morbi nunquam, ante, visi ingruebant, ferrentissimis intra viscera ardoribus, quibus homines quasi quadam rabie exagitabantur. Exorta etiam fames, frugibus tam ri tempestatis, quam verminibus corruptis, et lues non minus nocens pecori quam hominibus et multorum relictæ vacuæ possessionibus* (C. F. Heusinger, Fuchs).

The uncertainty relative to the form and nature of the epizootics is one of the most common facts in the records of the Middle Age. Thus the beginning of the famous black plague in 1347 was preceded in several countries by epizootics no less fatal. *In primis hæc acerba pestis in brutis animalibus incohabit; scabies et lepræ totaliter apprimebant equos, boves, pecudes, et capras; ita ut pili de dorsis ipsorum depilabantur et cadebant et effliciebantur macri et debiles, et post paucos dies moriebantur. Deinde incipit hæc rabiosa pestis per universum mundum discurrendo in miserabiles homines lethaliter sævire* (Cutteis). This passage evidently refers to a gangrenous affection, which has nothing in common with *feu sacré*, for with the exception of the epidemic of Brittany, which occurred at the beginning of the black plague, no traces of ergotism are found until 1373, when it appeared anew in France (Tessier).

During the whole period of the Middle Age but rare epidemics of *feu sacré* are mentioned in the north of Europe. Heusinger believes that those of the fifteenth and sixteenth centuries, designated by the name of scorbutus, belonged to ergotism. This opinion appears to us to have foundation; in fact the celebrated botanist, Dodonæus, described the epidemic of scorbutus, which occurred in Belgium in 1556, and was characterized by gangrene of various parts of the body. He attributed it to the spoiled grain which was imported from Prussia, and says in another work (*Historia frumentorum*, Ant., 1569), that bread made from spoiled rye (*seigle altéré*) causes the disease called by the Germans scorbutus. The gangrenous form of this affection, which did not conform exactly to that observed in France and Spain, was replaced in the course of the sixteenth century by the convulsive form. When the epidemics of ergotism of the South and those of the North of Europe are compared a very remarkable fact presents itself; in the South the gangrenous form is the rule; a few of the epidemics were complicated by muscular contractions (*contractures*); in the North,

* The author appears to have overlooked the fact that such a disease might have been produced by ergotized grasses.—D. E. S.

on the contrary, dry gangrene was a rather rare affection. This phenomenon is applicable to animals with which ergotism has been observed during the continuance of an epidemic as well as with those experimented upon. Fowls are the only exception, and with these gangrene of the comb is an almost constant result. Do the properties of ergot of rye differ in the north and in the south? Chemical analyses may, perhaps, inform us; in waiting for these we may admit that the phenomena are not dependent upon the dose. In 1840, after threshing, ergot made up half the harvest of Finland. The epidemic showed itself as acute febrile, convulsive ergotism. Death very often occurred within forty-eight hours (Haartman).

Dating from the seventeenth century observers were more attentive to the phenomena presented by animals during the epidemics of ergotism, but they notice the fact with a briefness which cannot satisfy the science of pathology, because the proper elements are not furnished for retracing the medical history. Brunner, the recorder of the epidemic of 1694, in *le Harz*, limits himself to this phrase: *Novi pecora, armenta, sues, equos, anseres quoque non fuisse a contagione immunia*. In spite of the contagion which he admits, Brunner leaves nothing equivocal in regard to the cause, for he says: *Degeneravit quoque secale et loco granorum alimentariorum protrusit cornicula nigra*. The *quoque* relates to oats which had equally undergone degeneration, the characters of which are not indicated; its meal produced vertigo in the persons who consumed it. It would have been interesting to indicate the effect produced in horses, but the author maintains an absolute silence in regard to this. Though distinguished botanists affirm that the oat is subject to ergot, we must admit that our researches to discover a fact where the injurious properties of ergoted oats have been noticed with animals have remained without success.

In the description of the epidemic in Silesia in 1722, we read that the King of Prussia ordered an exchange for sound rye of that affected with ergot, which, as usual, caused sickness of the horses and hogs (Hecker). Convulsive ergotism reappeared in Silesia and Bohemia in 1736. Antoine Soring, the historian, makes the remark that it is known and demonstrated by experiment that ergoted rye produces disease with fowls and mammals, and that when animals suffer during the epidemics of ergotism it is conclusive of the quantity and violent action of the ergot in the rye.

From 1765 to 1769 ergot was very abundant in Sweden in the rye and barley. The epidemics which followed were attributed by Linnæus to the grain of the *Raphanus raphanistrum*, from which is derived the name Raphania, which in Scandinavia is still given to convulsive ergotism. Wahlin, after having experimentally demonstrated the innocuousness of the seeds of *Raphanus*, observes that there is no reason for not accusing ergot when, in the course of an epidemic, domestic animals such as fowls and hogs present similar symptoms to what are seen in man. This passage tends to prove not only that the domestic animals contract convulsive ergotism, but also that the ergot of barley is as dangerous as that of rye. This is, besides, confirmed by Retzius when he asserts that beer brewed with ergoted barley becomes a cause of convulsive ergotism for those who consume it. In Hesse, it has been often observed, notably in 1770, that the heads of barley contained as many, if not more, long, black grains as the rye. In our times (1856) this same remark has been made by T. O. Heusinger.

Traube, who left a much esteemed description of the epidemic of 1770, which was very extensive in Hanover, says that so far as he was able to observe the facts for himself, he saw in the circle which he traversed a single pig attacked with convulsive ergotism. Horses eating the ergoted bread were not incommoded; bovine animals consumed the flour with repugnance, but also without inconvenience. Dogs and sheep were not affected, with the exception of the little village of Lohe, where 7 sheep succumbed after presenting the phenomena of the convulsive disease. These animals had pastured on the rye fields after the harvest, which was made in a very dry time, when an abundance was lost by shelling. Traube did not discover a single case of abortion which Soring and others thought they observed with hogs. One fact impressed him: traveling through the villages which still contained the suffer-

ers, the following spring, he heard general complaints in regard to the small number of the young fowls. But few eggs were produced, and the hens did not sit. Nothing of the kind occurred in the villages which had been exempt from ergotism. Two fowls were sent him which presented the spasmodic symptoms; these birds, placed upon their feet, fell to one side, allowed the head to hang, and agitated the limbs. When they arose of themselves the phalanges were contracted spasmodically; they lived four weeks; no autopsy was made (*Geschichte der Kriebelkrankheit*, 1782, pp. 13 and 15).

It is seen that in these epidemics the convulsive form predominates, while in France the gangrenous form is almost exclusive. The last extensive epidemic from which this country suffered occurred in 1750, and the ravages at this time recalled those of the Middle Age. It commenced in Sologne, its traditional center, and extended through Landes, Flanders, and Artois. The ergot formed a third of the threshed rye; animals which were fed upon it contracted the same gangrenous accidents as man (Salerno).

Toward the last third of the eighteenth century the epidemics of ergotism were no longer so frequent; the perfection of agriculture may claim a part in this happy result, but the greater part is incontestably due to the generalization of the culture of the potato in the North and of maize in the South. In spite of these alimentary guarantees ergotism was not extinguished. In the present century it was mentioned by Courhaut and Bordot, in 1855; Barrier observed the gangrenous form in the departments of Isère, Loire, Haute-Loire, Ardèche, and Rhone. Ergotism has reappeared in Russia, Finland, Sweden, and some cantons of Germany. In the epidemic described by Wagner (1831) the hogs which ate ergoted rye presented the same symptoms of the disease as the human species, and Helm saw in Pomerania 12 hogs which, a few hours after having consumed a ration of rye mixed with ergot, were taken with vertigo and convulsions. They moaned and uttered anxious cries; the posterior parts were paralyzed, and the animals manifested their sufferings by singular contortions. The last epidemic occurred in 1855; it appeared in Hesse, and concurred with that mentioned in France by Barrier.

A peculiarity worthy of remark was connected with the Hessian epidemic; the younger Heusinger, who recorded it, says that his father, professor at the University of Narbourg, who was charged by the Government to examine the harvests of the year, accomplished his mission before the threshing. In the sheaves of the cereal he found a large quantity of *Bromus secalinus* [common chess or cheat] rich in ergot, though the heads of the rye were exempt from it; and as this ergot presents all the physical characters belonging to that of rye, it becomes certain that this cereal is not always to be blamed as much as has been generally believed. Rye harvested on lands badly cultivated was infested with *Bromus*; when properly cultivated but little was produced. This fact demonstrates the great influence of agricultural progress on the extension of ergotism and its cause. In countries where agriculture is in an advanced condition, as in Belgium, ergotism, either in the gangrenous or convulsive form, is unknown. The observation of Heusinger is not the only one; in two communes of the principality of Waldeck the ergot of chess also caused an epidemic (Rørig).

This fact is not without interest for the veterinarian, since straw makes up part of the food of the domesticated herbivora, and the plants mixed in the sheaves, with the nature of their productions, merits more attention than is generally bestowed upon it. During the continuance of the epidemic in Hesse, T. O. Heusinger collected information in regard to the diseases which affected domestic animals. He learned that in the commune of Roda, where the most people suffered, and where convulsive ergotism was most violent, the sheep presented symptoms which could be referred to poisoning by ergot with the more reason as these animals were fed with rye straw and received the screenings of the grain. The inhabitants complained of the great mortality among the sheep; the shepherds reported that several had jumped the inclosures of the pastures, that they were then taken with convulsions and turning in

a circle had dropped dead as if thunderstricken. Abortions were frequent, as also early parturitions; the greater part of the lambs died.

Doctor Randall reports that in the State of New York a disease appears each winter among the cattle, which begins by a slight swelling of the lower parts of the posterior limbs, with stiffness of the joints. This affection, which has the appearance of being very mild, invariably terminates by dry gangrene of the parts first involved, which freeze after the mortification. In the severe climate of New York the animals winter in the fields, and the farmers attribute the disease to freezing. Randall observes that if this were the real cause a circular line of demarkation would not divide the dead and living parts as regularly as happens in this disease, and, finally, that the external appendages, less protected against the cold than the limbs when lying, should freeze sooner. He adds, and it is the opinion of several other physicians, that the affection is no other than gangrenous ergotism. Indeed the *Poa pratensis* is rich in ergot, and as it does not produce each year an equal quantity, Randall thinks that the cases more or less frequent correspond to the abundance of ergot. (Veterinarian, 1849.)

If, in presence of the facts enumerated, we cannot fail to recognize the existence of gangrenous and convulsive ergotism with animals, we must also admit that these facts are neither so precise nor have the rigorous correlation of cause and effect which is desirable in pathology; they do not even give the elements for a symptomatic table. Randall furnishes in this connection some important information; it agrees with that contained in the interesting observation of Decoste. (Rec., 1848.) These materials joined to the phenomena studied with animals in experiments permit us to trace the symptoms of gangrenous and convulsive ergotism.

Mr. Fleming, in his work entitled *Animal Plagues*, has compiled a considerable number of references to epidemics and epizootics of ergotism, which, while they contain a large part of the early records relating to this interesting subject, also illustrate the difficulty in deciding at the present time in regard to the real nature of some of the diseases to which allusions are made.

In A. D. 992 there was a long and severe winter and an extremely dry summer, followed by famine. The wheat crops were affected with blight or ergot, and the forage was generally of a bad quality. Soon after there was a widespread and deadly epidemic of ergotism (*feu sacré*) in France.

Ergotism was again prevalent in France in 994. (An. Pl., I, p. 58.)

In 1041 there was most unpropitious weather, accompanied by earthquakes, tempests, and inundations. It snowed heavily during harvest time. In many parts of Europe there were heavy rains throughout the year. Flanders was inundated by the sea, and there were great storms. The consequences of these disturbances were famine and disease in England, Germany, and France. Cattle and men appear to have suffered equally. "The plague of Divine Fire (*ignis divina*, ergotism, or erysipelas) afflicted many, who were saved only through the merits of the Blessed Virgin. And in all that year it was very sad in many and various things, both in tempests and in earth's fruits. And so much cattle perished in this year as no man before remembered, both through various diseases and through bad weather." (An. Pl., I, pp. 60, 61.)

For 1085 Mr. Fleming makes the following record: Epidemic erysipelas (ergotism?) in France, with inundations and famine. "In the year

1085 there was disease in plants, and also in animals, throughout the world." (An. Pl., I, p. 63.)

In 1089-'91, on the Continent, "in these years many men were killed by the *ignis sacer* (ergotism or gangrenous erysipelas), which destroyed their vitals, putrified their flesh, and blackened their limbs like to charcoal. Even if their lives were preserved their extremities were so affected that they were only reserved for a most pitiable existence." This epidemic is mentioned by several ancient chroniclers. Animals suffered as well as the human species. (An. Pl., I, p. 64.)

In 1099 gangrenous erysipelas (ergotism?) in France in the human species. From the severity of the epidemic, we may infer that animals also suffered. There were great inundations in England by the sea and by the rivers, whereby people, cattle, and whole towns were drowned. (An. Pl., I, p. 65.)

In 1127 the "divine plague" (ergotism?) appeared in mankind in France. Prayers to the Virgin Mary healed the afflicted, it is recorded. Great pestilence among animals.

In 1213 gangrenous erysipelas (*feu sacré*) in mankind in France and Spain.

Neither was the scarcity limited to the fruits of the earth, nor disease to the human species, for birds, cattle, and sheep became sterile, and brought forth no young, and many riding and other horses perished for lack of straw and barley. (An. Pl., I, p. 71.)

In 1598, after inundations and heavy fogs, there was a general epizooty among cattle in Germany. In the same year there appeared ergotism in the human species. (An. Pl., I, p. 138.)

In 1694 an eruption of Mount Vesuvius. A supposed epidemic and epizooty of ergotism. Brunner writes:

By what unfortunate combination of circumstances, for so many years, the whole of nature seemed to labor under an unhealthy atmosphere remains a secret. Many men, and those most learned, have written on the state of the air, and I have been a spectator of most grievous calamities; for not only did unwonted fevers attack and kill the human race, and would submit to no remedies, but also the beasts were harassed by deadly diseases. I know that sheep, cattle, pigs, horses, and geese were not free from the contagion. There was also a lack of corn, not only on account of the inordinate consumption of it by the soldiers, but also from the character of the ground. Some of the corn was so plainly diseased that it was dangerous for man to eat of it. I know also that pease, which formed a great part of the food of the army, were infested and diseased by a small insect, which made a minute hole in them. I never remember seeing such an abundant crop of darnel (tares) mixed with the oats, and which prevented the making of good oat meal, our chief food, for it was needless to attempt to labor on it, it was so bad. All grain disappeared, and in its place small, black, horn-shaped masses became apparent, which were highly injurious to mankind. These were named "St. Martin's corn." A woman was shown to me by a surgeon who suffered from convulsions every eleventh day, solely from eating this corrupt grain, and the same surgeon told me he had amputated a leg mortified from the same cause. (An. Pl., I, pp. 166-167.)

In 1721 the winter was mild, but the spring time cold and damp, and the remainder of the year wet. Locusts in France and the whole of

Italy. Epidemic ergotism in Silesia during this and the next year, and scarlatina in man at St. Petersburg, Courland, and Lithuania. So notorious was it that diseased grain produced formidable diseases in the lower animals, that while the epidemic continued in Silesia the King of Prussia issued an edict forbidding the use of rye tainted by the ergot, because it seriously affected horses and pigs. (An. Pl., I, p. 234.)

Another strange phenomenon was the generally laborious parturitions of the domestic animals at this period :

The sheep in many places lambed with great difficulty, so that the shepherds were obliged to use force to deliver them. Among the cattle one hears of nothing particular beyond the fact that the breeding cows and ewes brought forth their young with great difficulty so that force was obliged to be used to assist them. At Strelitz three fine young cows died from this laborious parturition. They strained so violently that all their internal organs were protruded. (An. Pl. I, p. 235.)

In this connection Mr. Fleming gives the following quotation from Hecker :

The uncertainty pertaining to the nature of epizootics of the Middle Ages, leaves us in doubt as to whether some of them might not belong to that class which have a common origin with many of the epidemics of mankind. *The ignis sacer, arsuræ, claudes seu pestis igniaria, ignis Sancti Antonii, Sancti Martialis, Beate Virginis, ignis invisibilis, seu infernalis, &c.*, would all seem to be employed to denote the same affection, and which we have reason to believe was ergotism. It is only by chance, as it were, that wide-spread and fatal diseases among the lower animals are mentioned as occurring coincidentally with those obscurely named epidemics, and when we read that the causes of their outbreak were unfavorable weather, which brought about a diseased condition of the crops and pastures we are only partially enlightened as to the nature of the affection.

The scorbutus of the fifteenth and sixteenth centuries has been supposed, with much reason, I think, to have been ergotism, and up to this period it appears to have developed in a gangrenous form. At this time, however, it changed to the convulsive type, which it has chiefly maintained to the present. A curious feature in this disease is shown as it appears in the South and North of Europe. In the South, the gangrenous form is the rule; in the North the convulsive form is particularly marked, and very rarely the dry gangrene; while a few of the epidemics present both characters. The same peculiarity is observable in the phenomena of ergotism in the lower animals during the existence of an epidemic, and it has also been shown to exist by experimentation; the only exception would appear to be in the case of gallinaceous birds, in which gangrene of the crest or comb is the most constant phenomenon. It is not until the seventeenth or eighteenth centuries that we can with certainty find authors describing ergotism in the epizootic form in animals and from that time till now observers have been numerous. (Page 234.)

Convulsive ergotism appeared in mankind in Silesia and Bohemia (1736), and Antoine Soring, the historian of the epidemic, notices that it had been remarked, and the subject had been demonstrated by experiment, that spurred rye produces disease in fowls and mammiferous animals, and that when we know positively that animals are affected in this way during epidemics of ergotism, we may conclude that the rye is very rich in ergot, and its action very violent. (An. P. I, p. 262.)

In 1754 a very extensive epidemy of ergotism prevailed in France, nearly approaching in its ravages those of the Middle Ages. It began at Sologne, its traditional birthplace, and spread through the Llandes, Flanders, and Artois. The ergot was so abundant that it formed one-third of the rye. The animals fed on it contracted the same gangrenous diseases as afflicted the human species. (An. Pl. I, p. 384.)

The next outbreak referred to is described as follows:

An epidemy of ergotism was also reported as occurring in many northern countries, caused by the wheat, rye, and corn having been diseased. It lasted during this and the next year, and animals seem to have suffered. Wagner described it as it appeared in the marshy districts of Saxony, the circle of Schlieben, and on the banks of the Elster: "A light frost destroyed the blossom on the vine and the rye in 1831. Each partially withered blossom of the rye crop, instead of a healthy seed, brought forth a spur of ergot about three-fourths of an inch long. * * * In some houses, where the disease raged most violently, grain was found consisting of two parts of diseased and one of bitter rye, vetch and a variety of other seeds. * * * Pigs ate ergotized rye (*Mutterkorn*), and suffered from its effects. Dogs, however, instinctively, avoided it; but when compelled by hunger to eat it, they exhibited symptoms of madness (*Tollwuth*). I believe that such food was partaken of here and there by dogs, and that it assisted in producing madness, as dogs and cats were so affected that no man ever remembers seeing so many mad as during the existence of the ergotism (*Kriebelkrankheit*) among the people. This unhealthy grain may have had something to do with the sickness among the lower animals which prevailed at this time, and which was ascribed to the choleraic influence, though its share must have been small." (An. Pl. II, p. 172.)

Raphania in pigs was witnessed by Dr. Helm:

Twelve pigs of various ages were fed with rye which contained much ergot. A few hours afterwards convulsions set in, with foaming at the mouth; the animals grunted and groaned most piteously; became paralyzed in the hinder extremities, and expressed their agony in the strangest contortions. At first I presumed the disease arose from the bite of a mad dog, but on opening the first animal that died I discovered the nature of the malady by finding in the stomach much ergoted rye. The jaws were so tightly closed that with great difficulty a purge of white hellebore was introduced, and that was followed by a dose of vinegar and buttermilk and repeated douches of very cold water. By these means seven of the animals were saved. The other five died in the course of a few days. (An. Pl. II, p. 197.)

In our own country we have no compilation of the references to animal diseases which may have been made from time to time, and hence it is impossible for me to give a history of ergotism in this country. My attention, however, has been called to the following article in the *Farmers' Cabinet*, Vol. III (1838-'39), p. 161, which shows not only that the disease has occurred heretofore, but that its cause was recognized:

I have just seen a number of the "Farmer and Gardener" of Baltimore, dated 19th June last, which contains an article on the "Hoof-ail" of cattle, and copied from the *Genesee Farmer*, upon which I will make a few remarks.

The writer of the article, John B. Bowers, dates from Ledyard, and ascribes the loss of the hoofs in three cows to their having been fed for eight or nine days on spear grass (I suppose our green grass, *poa viridis*) affected with ergot. The conjecture is well founded, as you may be assured by referring to the fifth volume of the

Memoirs of the "Philadelphia Society for Promoting Agriculture," p. 196, where you will see a paper of mine on the subject, which I think will leave no room to doubt as to the cause of the disease. It is a curious fact that the ergot of rye, if ground into meal with sound rye, when made into bread and eaten produces mortification of the lower extremities in France. (See Memoirs of the same society, volume 3, appendix, p. 5.)

JAMES MEASE.

CHESTNUT STREET, October 6, 1838.

Dr. James Mease, the writer of the above, gives the following additional information on the same subject:

In the year 1803, the late Joseph Cooper, of New Jersey, informed me that he had observed the hay made of the natural green grass, or spear-grass (*poa viridis*), growing on his fine meadows, on Petty's Island, made by banking out the Delaware, to be occasionally affected with a black spear, about one-fourth or half an inch in length, somewhat resembling the ergot in rye, and that cattle eating such hay became affected with a disease in their hoofs, causing them sometimes to drop off. He ascribed the morbid production in the grass to neglect in supplying it with water from the river, by means of sluices, during the dry season. Upon my mentioning the facts soon after to the late William Rush, of Philadelphia, an extensive grazier, he confirmed them from his own observations at Blooming Grove, near Gray's Court, in the State of New York, in the winter succeeding the very dry summer of the year 1793. The hay was the produce of a bog meadow; it is presumed, therefore, that it was made from the same natural grass that grew in the meadows of Joseph Cooper.

Some years after, Mr. W. T. Woodman, of Tredyffrin Township, Chester County, Pennsylvania, communicated to me an account, in the following letter, of a similar disease, and from a like cause, among his father's cattle:

"Having observed the remark in the *Port Folio* for May, 1815, in the review of the third volume of the Memoirs of the Philadelphia Agricultural Society, that, 'as yet, in America we have never heard of any human person falling a victim to the ergot, nor indeed is it satisfactorily ascertained that it has ever been injurious to our animals, I think proper to communicate to you an account of a disease which in 1802 or 1803 prevailed in this neighborhood among milk cows particularly, but which also affected other cattle and horses. You will perceive that it was analogous to the one supposed to be occasioned by ergot.

"For my part I am entirely ignorant of the cause, but still I am unwilling to ascribe it to ergot (with which rye in this neighborhood is more or less affected every year), for this reason, that milk cows, which are never fed with rye by our farmers or butter-makers, exhibited more violent symptoms than oxen or horses.

"The farmers attributed the disease to a peculiar mildew, which sometimes affects the grass on the bottom meadows of a small stream, the basin of which is very extensive, and very luxuriant, and entirely appropriated to meadow land, and suffered to lie under natural grass. No timothy or other grass seeds have ever been sown on it, to my knowledge.

"The cattle affected did not appear to lose their appetite, and while they ate heartily of hay and other food became daily more and more lean, manifesting great uneasiness, occasioned most probably by violent itching. Their hair in many places fell off, or was rubbed off by the animal in striving to scratch itself. After these symptoms had continued for some time, one or both hind feet became sore and the hoofs loose, at which period the animals began to grow better. Others lost their hoofs and part of their legs. Three of my father's cows lost both of their hind feet, and some others in the neighborhood were equally as bad. The legs began by drying and growing smaller from the hoof to half way between the fetlock and the hock, at which

point it appeared as if a string of twine were tied very tight round the leg. Above this part the flesh was to all appearance in perfect health; the lower part was hard, black, and offensive. When the lower part became quite dry, and little else than bone, it separated and fell off, after which the animals lived and ate heartily, hobbling along on the remaining stumps. They even began to grow fat. Their health seemed perfect. They would, no doubt, have lived long in this state, and were killed only from motives of compassion.

"One cow belonging to my father, which had lost only one of her hind feet, and that at the first joint above the foot, bore a very strong, vigorous calf, which lived and did well. The cow also afforded as much milk after as before her misfortune, and was pastured on the same grass to which her disease was attributed when in a state of hay.

"I think the disease was never known but one season. The first symptom of it was observable in February, and it reached its crisis about the middle of May. Should this communication lead to any further observations on the nature and cause of the disease I shall be much pleased, and they may be of great service to the agriculturist. Should the disease ever again make its appearance I shall be more particular in my observations.

"I remain, very respectfully,

"WM. T. WOODMAN.

"P. S.—It should be observed, that though we have every year more or less of the ergot, the quantity of it is never considerable. I think there is seldom more than one pint to a hundred bushels of rye.

"Different remedies were tried, but none of them afforded any relief."

"Being desirous to ascertain whether the disease of the grass to which Mr. W. referred had grown in meadows that had been deprived of their usual supply of water, I addressed a letter to him in reference to this point, and received the following answer, under date of June 10, 1815:

"Your favor of the 30th ultimo came to hand the 4th instant. Since the receipt of it I have made numerous inquiries, for the purpose of obtaining additional information respecting the disease (of which I communicated an account), and on the season preceding its prevalence, &c; but I regret to inform you that farmers in general are so deficient in observation, and so entirely out of practice of recording facts, that I have not been able satisfactorily to ascertain whether the season in which the "injurious hay was made" was a dry one or not.

"However, my father informs me that, as nearly as he can recollect, about that period the ditch which conveyed water to his meadow became so filled with mud and accumulations of mud and other matter as to render the supply very imperfect. As a deficiency of water appears to be the cause of the unwholesome qualities of the hay, it is highly probable that the injurious hay was made during the season that water was wanting. But shortly after this time the death of my grandfather in a great measure excluded my father from the benefit of the water. The original plantation being divided into two farms, and that of my father lying farther down the stream, the water of the artificial course is exhausted before it reaches his land. It should, however, be remarked that since that period he mows his grass while it is very young, and before the seeds are touched by the "smutty affection." Indeed, the farmers generally in this neighborhood, since their cattle were affected with the disease, are careful to mow much earlier than they did formerly.

"I am strongly induced to believe that Mr. Cooper ascribes the disease to the proper cause, for I have been correctly informed that a load of the injurious hay was sold to — Rogers, who at that time kept the Buck Tavern, in second street, whose cow, in consequence of feeding on it, was affected with a disease of a similar nature.

Your friend, &c.,

W. T. WOODMAN"

The disease prevailed to a great extent in Orange County, New York in the year 1820, and is very well and minutely described by Dr. Arnell, corresponding secretary of the agricultural society of that county. The facts detailed by him leave no doubt of the deaths of numerous cattle in his vicinity being caused by their eating hay made from some grass that was affected with the species of ergot observed in the produce of the meadows before mentioned. for he expressly mentions that the spear grass grew in the meadows in the towns of Wallkill and Blooming Grove, where the disease prevailed, and in a bog meadow soil. Dr. A. remarks that, "the hay was cut in June or beginning of July, immediately before harvest; that only cattle in good condition suffered from eating the diseased hay, the poor and meager escaping." The means of prevention pointed out by Dr. Arnell are similar to that judiciously recommended by Mr. Woodman, viz., to cut the grass early, before the ergot forms; or, if it be found in the grass, to defer cutting it until late, when experience proves that it may be safely used; for Dr. A. remarks that "the ergot then becomes dry and shriveled, without any of the flour or vegeto-animal matter which it usually contains." But the hay made from such late-made grass must be of little value, because Dr. A. says truly that "this spear grass is so early that if left to stand till the usual time of mowing meadows it loses all its succulent and nutritious properties." This agrees with our experience with respect to the spear grass of Pennsylvania, where it ripens next in order to the early *Anthroxanthum odoratum*, or sweet-scented meadow grass. Still, however, it may be useful by answering one purpose of food in all animals: to stimulate by distention, and to add to the stock of barn-yard manure. The various remedies tried to cure the disease in New York are enumerated by Dr. Arnell. Those that succeeded were:

1. Poultices of soap, rye-meal, and salt, to the legs and feet.
2. A wash of beef-brine, composed of saltpetre, and common salt, applied several times a day, and after washing and rubbing the feet with the bitter-sweet ointment. Of the animals thus treated, one only lost its hoof.

In the treatment of the disease, the first object to be attended to is to remove the cause producing it. This is to be effected by drenches of castor-oil, or sweet-oil and molasses and water warmed, to which may be added, if found necessary, after the failure to operate of the first dose, half a pound of glauber salts, dissolved in warm water. During the operation of the drench corn meal, rye, or oatmeal, mixed with a large proportion of warm water, and a handful of common salt to every bucket of it, should be freely given. The use of hay free from ergot is as obviously indispensable. A handful of salt should be given every day to promote digestion and give tone to the system. The local applications must be of a stimulating nature to rouse the activity of the circulation and of the absorbents, and to enable the part laboring under a defi-

ciency of vital energy to resume its healthy functions, or to throw off the disease. Fish or beef-brine will answer as well as any, but they should be well rubbed on the feet and legs, for friction greatly tends to assist in restoring the health of the parts. To prevent the appearance of ergot in the grass, care should be taken, when practicable, to supply the meadows with water in dry seasons.

In the *Genesee Farmer*, 1857, p. 50, was published the following letter, clearly referring to this disease :

Perhaps you are aware there is a complaint among cattle occasionally, in this part of the world, and it may be in many others. I have heard of it in Canada. I do not know the correct name. It is not the hoof-ail, although it attacks the hind feet of cattle, and, if not arrested, the limb will rot off, up to the second joint of the leg, and the animal must be killed, or it will die; after it has proceeded so far as to be incurable, the only way is to knock it in the head.

I write this to inform your numerous readers of a cure we have here, although perhaps the remedy is generally known. It is to cut off the toes of the hind foot (in which only it appears), about an inch horizontal, so as to open the foot sufficiently there for the blood to come out; then put the foot in a stocking with plenty of tar at the toe. If taken in time this will effect a cure. It must be done early, however, when the animal first shows symptoms of the complaint, by a frequent and slight kicking out of the hind foot, as if pricked with something.

I have heard the cause attributed to poisonous hay, such as smut. Do you or any of your correspondents know anything about it? If so, let us have your, or their, experience.

CHILTON FORD.

MORRISTOWN, *Saint Lawrence County, N. Y.*

Again, in the same periodical, 1857, p. 245, we find the following report of this trouble in Portage County, Ohio :

In consequence of the appearance of a severe and fatal disease among cattle in some parts of Portage County (Ohio) the past winter, the Farmers' Association of Edinburg appointed the undersigned a committee to investigate the subject, and ascertain if possible the nature, cause, and cure of this malady. The report of this committee we herewith forward for publication in the *Genesee Farmer*, together with a resolution adopted by the association at the close of an instructive discussion upon the adoption of the report.

Report.—The disease is not caused by freezing, neither is it what is called hoof-ail, foot-rot, or founls. Its symptoms seem to be a deadness of the end of the tail, extending upward till in some cases the flesh separates from the bone and falls off. About the same time there is a purple appearance just at the edge of the hair, above the hoof. It then commences swelling, becomes feverish, extending upward to the ankle, and in some instances causing a separation of the coffin-bone from the pastern joint. The lameness is confined entirely to the hind feet. The blood is pale and thin, and in most cases the animal retains a good appetite till near the last. The cause we apprehend to be feeding on hay containing ergot (a parasitic fungus growing within the glumes of various grasses) in considerable quantities. We arrive at this conclusion from the fact that the hay fed by one individual who had lost a large number of cows contained much of this article, and also that the farmer from whom he purchased the hay lost cattle from the same disease, and in both instances cattle fed on other hay were not affected. In every well marked case of this disease it has been ascertained that the hay on which the animals were fed contained the ergot. The hay in which the ergot was found the most, was the kind called the June, or spear-grass, growing in old meadows where the soil is rich and the growth rank.

The severe frost on the 31st of May 1856, is supposed by some to have been the cause of this disease in the grass by destroying the vitality of the seed before it arrived at perfection; while by others it is attributed to the extreme warm growing weather in June causing an overflow of sap.

Although we consider the whole subject involved in much obscurity and uncertainty, and requiring further investigation, yet we are satisfied the best manner of treating the disease is immediate resort to restoratives and a change of diet, whereby an increase of animal heat and vitality is obtained, and at the same time making an application of suitable remedies to the affected parts, by cutting off the toes until they bleed, and blue vitriol moderately applied to the foot has in several instances been found beneficial. A free use of charcoal and salt in various ways is undoubtedly a good preventive; and a careful examination of the hay or grass on which stock is fed is indispensable; if ergot is found in hay it may be removed by threshing or tramping.

Of the specific nature and properties of the ergot in hay, or whether they are identical with that of rye, we are not well informed. The immediate effects of the latter in large doses is well known, but it has no affinity to the ordinary known effects of vegetable poisons. What effect would be produced by its gradual and continual use we are not in possession of sufficient information to warrant us in speaking positively; but we do suppose, after a careful examination, that it operates on the blood of the animal, and unless immediate remedies are applied it proves fatal.

P. BARRON, M. D.,
R. M. HART, Esq.,
J. Y. PEARSON,
JONAS BOND,

Committee.

The following resolution was unanimously adopted:

Resolved (inasmuch as the evidence adduced is conclusive), that ergot in hay is the cause of this disease. The association cannot decide that it is the real cause of a poison being introduced into the system, owing to our inability to analyze this substance; therefore we desire to ask the editors of our agricultural papers for more information, and to obtain a chemical analysis of ergot.

In the *Chicago Tribune*, March 14, 1884, appeared a letter signed J. Hosmer, containing the following paragraph, which, while it refers the disease to a different cause, evidently describes the same affection:

In 1873-'74, in Chariton County, Missouri, the winter was very severe, the mercury going to more than 20° below zero. The people on the open prairie, mostly Germans who had recently moved there, seeing that the native Missourians provided no shelter for their stock provided none themselves. In the spring from one to three in a flock of eight to ten had the "black leg." It commenced to separate just where the skin joins the hoof. The animal being in great pain, lapped the infected part, and the poison was thus transferred to the mouth. It was nothing more or less than gangrene, as the leg rotted and became putrid.

In the month of February, 1884, a letter written to the editor of the *Breeder's Gazette* by Cushman Brothers, of North East, Pa., in regard to a strange disease of dairy cattle there was referred to me. This letter, written February 19, and a second one from the same gentlemen, dated March 8, in reply to some inquiries of mine, contained the following information:

The dairy in question contained 18 cows, and the disease appeared about January 1, 1884. The first indication was "cocked" ankles behind,

the legs beginning to swell in a few hours, and in two days were "as large as the skin could hold." This swelling only extended as high as the hock joint. In about a week the hoofs began to come off; the parts beneath were red, but there was no formation of pus. The feet were apparently healthy between the claws, the appetite good, the eyes bright, and the cud regularly masticated. The animals had been kept in a warm stable all winter. At the latter date mentioned four had been killed, their appetite having finally failed, two more were very bad, "a scab having formed from top of hoof to several inches above ankle and leg rotting off;" the foot of one animal had come off at first joint above the hoof, the fore feet of none had been affected but with two the fore-legs were then swelling above the knees. One that had been affected without losing hoofs and had apparently recovered, was taken down a second time. Many people said their feet were frozen, but the owner says they have now changed their minds. He had looked carefully in their mouths for sores but had found none.

This was undoubtedly ergotism, and was so diagnosed by Dr. Germer, the health officer of Erie, Pa., after the Kansas disease had been attributed to this cause.

In recent years several epizootics of ergotism have also been observed in New York by Professor Law, in Iowa by Professor Stalker, and in Colorado by Professor Faville; and it seems probable that when our veterinarians learn to recognize this disease and to refer it to its proper origin, we shall find that it is not an uncommon affection of cattle.

TREATMENT AND PREVENTION OF ERGOTISM.

When the first signs of this disorder appear the most important point to be attended to is to make a complete change of food, and to see that this is of good quality, nutritious, and free from ergot. It would also be proper to give a dose of physic (from one to two pounds of Epsom salts), in order to remove as much as possible of the poison still contained in the digestive organs, and to follow this with soft food, as mash and roots. In the most severe cases, those in which a part of the limb is already lifeless, treatment will avail but little. The greater number of cases, however, have not advanced to this stage when lameness is first noticed, and these will be greatly benefited by removing the cause, and placing the animal under conditions favorable for resisting the poison. A very important condition is warmth. Even when animals are fed large quantities of ergot they seldom suffer except in cold weather; and consequently in attempting to check the advance of the disease, advantage should be taken of this fact by placing the cattle in warm sheds.

Another condition believed by some to have much influence on the development of ergotism is the water supply. With plenty of water always at hand it is believed that larger quantities of ergot may be taken for a longer time than when the water supply is deficient. In the cold winters which occur over much of our cattle-raising country, it is difficult

to induce the animals to take a sufficient amount of water. Holes cut through the ice soon freeze over, and the weather is frequently so severe that the cattle will drink only a few swallows of water before they will leave to seek a shelter from the cutting winds, and when, later in the day, they try to obtain more water, the drinking holes are frozen over. Where ergotism prevails the watering should receive close attention.

Ergotism can probably be entirely prevented by cutting the hay before the seeds have formed. Both in Missouri and Illinois I saw the clearest examples of this. Hay composed of the same kinds of grass, cut upon the same land, was free from ergot or largely infested with it, according as it had been cut green or ripe. This matter is worthy of careful consideration. Hay cut green is more digestible and in every way more valuable than that which is allowed to become ripe and woody; and the latter is much more liable to produce severe disease, such as indigestion, impaction, and ergotism.

This fatal disorder may, therefore, be prevented in the future by proper and careful management; the chief points in this being to cut the hay before the seeds have formed, to see that the animals have a sufficient quantity of drinking water, to keep them in good condition by the liberal use of nutritious food, and to protect them as much as possible from the inclement weather. When it is found necessary to feed hay which contains a considerable quantity of ergot it is of course doubly important to look after the water supply and the shelter.

GEOGRAPHICAL DISTRIBUTION OF SOUTHERN CATTLE FEVER.

An approximately correct outline of the district permanently infected with southern fever is a matter of supreme importance, not only to the people who live within and near this district, but to those interested in live-stock in every part of the country. The losses which occur every summer, and which in some years have been really disastrous to the stock owners of certain sections, have been largely the result of ignorance of the districts from which it is dangerous to bring cattle in summer, and to which adult cattle cannot be taken with safety at any season of the year, unless they are to be slaughtered for beef within a short time after their arrival.

An attempt to make efficient laws to guard against this malady by regulating the movement of cattle from infected localities has generally failed to give relief, because these districts could not be accurately designated. States, therefore, as well as individuals, have been unable to protect themselves, and the losses have gone on year after year in spite of individual precautions and State laws. The cheap cattle of Georgia, Alabama, Mississippi, Arkansas, Southeastern Virginia, and other infected sections are at times carried to the most remote sections of the country, and when this is done in spring or summer extensive

and fatal outbreaks of southern fever among the susceptible animals which cross their trail or mix with them upon their pastures is the general result.

Last year such outbreaks of disease are known to have occurred in New York, New Jersey, Pennsylvania, Maryland, Virginia, West Virginia, Ohio, Illinois, Missouri, Kansas, and even in Dakota. Colorado and Wyoming seem to have escaped, notwithstanding the introduction of Southern cattle, and this was probably due to the peculiar climatic conditions, the excessive dryness of the atmosphere preventing the multiplication of germs and soon destroying them.

It is evident, however, that this disease may be carried to most parts of the country, and that before anything can be accomplished toward preventing the very important losses which are now annually caused by it, we must have more accurate knowledge of the section from which cattle are liable to carry the infection. To obtain the information necessary to map out the infected district special agents have been employed, who have carefully traversed every county along the border-line of this district, and have investigated the cattle diseases with sufficient detail to locate the limits of the infected district in most counties with very great accuracy. In some counties a sharp line cannot be drawn, because it does not exist, but in such cases the line has been drawn sufficiently toward the uninfected district to embrace, as is believed, all the territory that was really infected at the time of examination. As this district is being continually enlarged by a gradual though very slow advance of the infection, it is not safe to buy cattle near this line for shipment to the North in summer, unless a careful personal investigation is made by the purchaser at the time.

The infected part of the South is clearly shown on the accompanying maps. To establish the boundary-line of this district beyond controversy our special agents have carefully reported the individual experience of thousands of farmers, and others who have moved cattle either northward or southward in the vicinity of this line. These reports are far too numerous and voluminous to publish in detail, and, consequently, a simple résumé of the facts as they are known to exist is all that we have attempted to give in this report. The location of the border-line of the infected district is as follows:

VIRGINIA.

The northeastern extremity of the line is in Accomack County on the Atlantic seaboard. The permanent existence of the disease on this peninsula has not heretofore been suspected by the country at large. A few facts had come to our notice within the past year or two which seemed to indicate that certain outbreaks of southern fever in Maryland had followed the introduction of cattle from Northampton County, which covers the extreme southern part of the peninsula. At the time it

seemed impossible that this disease could have secured a permanent lodgement so far north, and the reports were scarcely credited.

A careful examination of the peninsula, however, has demonstrated the existence of the infection of southern cattle fever throughout Northampton County, and extending for 2 or 3 miles across the boundary into the southern part of Accomack County. The infection seems to have been in Northampton County so long that no one remembers a time when it was absent. It is said that there are local laws prohibiting the movement of cattle from Northampton to Accomack at any season of the year, but that recently they have not been strictly enforced. In 1880 a considerable number of cattle that had been running upon commons in Accomack County, 2 or 3 miles from the southern boundary, died with symptoms of southern fever. It was found by investigation that more or less cattle had died from pasturing on these commons every summer for the past ten years.

In April, 1881, a drove of about 50 head of cattle was collected in Northampton County and driven to market across Accomack. At Puugoteague a stop of several hours was made, and here at least six head of cattle contracted the disease during the following summer and died. Two miles farther north another halt was made for dinner, and in this vicinity nine of the native animals died. Twenty miles north of this the herd seems to have stopped again, and here a large number of native cattle died.

There seems to be no reason to doubt, then, that Northampton County has long been infected, and that the cattle from that section when driven among susceptible animals produce the same fatal results as has long been recognized to follow a similar movement of Texas and Gulf-coast cattle. The infected part of Accomack County is very narrow, perhaps not more than 5 miles wide, and it is said that the disease is more malignant toward the seacoast than it is in the parts which border on the bay. This is in harmony with the fact that southern fever is known to have existed along the seacoast in North Carolina and Virginia for many years before it invaded the interior.

A careful investigation of the counties north of the Rappahannock River failed to reveal any trace of the disease. Not only were all the cattle apparently in good health, but imported cattle had remained free from disease after their introduction. Several instances were related of bulls being brought from North or West and continuing to thrive in their new home. According to all the information attainable, then, there is no permanent infection north of the Rappahannock River.

Coming south of this river, we find that cattle brought from Gloucester and Matthews Counties to sections of the State farther north and west infect pastures and thus destroy native animals. The facts obtained indicate that Middlesex County has become entirely infected, but we were unable to obtain evidence of any permanent infection in Essex County. In King and Queen County the infection has reached

the pastures in the vicinity of King and Queen Court House within the last four or five years, and it now survives there through the winter. Ten miles north of this cattle are susceptible to the disease and suffer when on the same pastures with others from south or east of that locality. While therefore the southeastern part of this county is certainly infected the greater part is still free. The same phenomena in regard to the extension of the disease that has been noticed in other parts of the South were also apparent here. The effects of the disease had been apparent for twenty years south and east of the courthouse, but the pastures here had not become infected until about five years ago, and since then cattle have been frequently lost. In Caroline County there was an outbreak of disease in 1881 caused by cattle from Gloucester County.

In King William County we find the infection permanently located on the Pamunkey River 8 or 10 miles above the New Kent County line, where it seems to have been for the past twenty years.

In Hanover County the permanent infection has been at Hanover Court House and Ashland for a considerable number of years. It is well known to the inhabitants that cattle brought from north or west of these places are nearly certain to die either the first or second summer after their arrival. The infection has extended but little beyond these two points.

Henrico appears to be entirely overrun with the infection. All the cattle sold from this and the surrounding counties go to Richmond either to be killed for beef or to be shipped by boat to other markets, and consequently there is little opportunity to collect instances of disease caused by cattle carried from here to uninfected localities. On the other hand it is admitted pretty generally by those who handle cattle that it is very dangerous if not absolutely fatal to bring these from the elevated sections of the State to any part of this county.

In Goochland County there have been very few cases of disease for a long time, but the southeastern extremity of the county is recognized to be dangerous to northern cattle. Farms on the James River three or four miles above Goochland Court House lose a few animals from year to year with southern fever. There is, however, little opportunity for the disease to occur, since the traffic in cattle is not extensive. Animals are not brought from north or west because of their liability to become affected, and they are not brought from the South because this is believed to be dangerous to the natives.

Powhatan County is undoubtedly infected, and has been in this condition for many years. It is reported by all the farmers along the James River to be absolutely fatal to cattle to be brought from north of the river to the south side. They suffer to the same extent when simply carried from the north to the south bank as when the distance is greater. Cattle from this county have long been considered dangerous to the native stock with which they came in contact when being driven to lo-

calities farther north. The introduction of this disease is not remembered by the oldest inhabitants, but so far back as the memory of man goes the present conditions have prevailed.

Cumberland County does not appear quite so thoroughly infected. At Trenton Mills and McRea's there is no doubt of the permanent infection, but the southern extremity of the county still seems to be free from it. In the counties along the river it is very plain that the sections immediately adjacent to the river have been longer infected and that the disease here is more generally diffused and more virulent than in the same counties at a greater distance from the water. And accordingly as we attempt to investigate the condition of other sections we encounter the difficulty of finding a smaller number of cases and a greater uncertainty in the minds of the inhabitants as to whether the native pastures really hold the infection from year to year, or whether each outbreak is the result of a fresh importation.

In Buckingham County our reports confirm the statements that were made last year. The infection extends up the south bank of the James River to a point slightly beyond the confluence of the James and Slate Rivers. From here the boundary line of the infected district passes up along the west bank of the Slate to Diana Mills; then the direction is a southeastern one to the vicinity of Gravel Hill, and to McRea's, in Cumberland County.

In Amelia and Nottoway Counties it has been impossible to trace any line or even to demonstrate the complete infection of the territory. It is generally admitted that twenty years ago and longer there was a complete infection of this district, but of late years there has been much less disease and it has become possible to bring in cattle from north and west with safety. In these counties there are no fences, and each man must necessarily keep his cattle upon his own pastures; as a consequence there is none of the indiscriminate mixing of cattle which used to occur, and the chances of contagion are greatly lessened.

While there have been considerable losses in Prince Edward County there is little evidence of permanent infection, except, perhaps, in the extreme eastern part. Most of the cases seem to have been the result of pasturing on commons that had been frequented by animals from Lunenburg County.

In Lunenburg there is no doubt of permanent infection. It is dangerous to bring cattle from west or north into this county, and, on the other hand, cattle from this county have frequently spread disease when driven toward the west or north.

In Charlotte County the boundary of infection becomes plainer and follows very nearly the line of the Richmond and Danville Railroad in its whole course across the county.

From the point where this railroad crosses the Staunton River to the North Carolina boundary, the line of infection was definitely located in my last year's report. The accompanying map delineates the portion

of Virginia permanently infected with southern cattle fever as correctly as this could possibly be done. Parts of the line have been retraced three and four times in order to have it satisfactorily located.

NORTH CAROLINA.

The Blue Ridge Mountains of North Carolina are now looked upon by the people of this State as the practical boundary line of the district permanently infected with southern fever. At some points, as in Wilkes County, the infection has not quite reached the mountains, and at one other point it has crossed the ridge and invaded Henderson County. The laws of the State, however, make the Blue Ridge the line, and prohibit the movement of cattle from the eastern counties at all seasons of the year.

SOUTH CAROLINA AND GEORGIA.

The whole territory of South Carolina seems to have been overrun with this infection. The Blue Ridge Mountains, which form a part of the northwestern boundary of the State, have here been crossed by this contagion and are no longer to be considered as the line. The infected district beyond these mountains is, however, at present of small extent, and the advance is so slow as to be scarcely appreciable.

The small portion of Georgia which has heretofore been considered free from this infection is being rapidly overrun; and it is now doubtful if any of even the northern tier of counties can be considered entirely free. The mountain sections are not so thoroughly infected, and it is probable that Towns, Union, and Fannin Counties are practically free from the permanent infection.

Whitfield and Murray Counties have been quite thoroughly inspected and the commons of both found to be infected in all parts. Many of the farms are also infected, but some still remain free, especially near the northern boundary. Cattle taken from these counties to the mountain ranges of Gilmer for pasture have not so far as has been ascertained caused any outbreaks of disease. This is probably due to the fact that Gilmer County is also pretty thoroughly overrun.

Here, as in many other localities, there are evidences of a different intensity of the contagion in various parts of the counties, but more particularly in different sections of the State. Thus, cattle which have pastured on the ordinary infected ranges of Whitfield County without harm, have become diseased as a consequence of feeding along the trails and on the commons where cattle from Southern Georgia had lately grazed. The movement of bovine animals from one farm to another or from one county to another is also considered dangerous. The fatigue induced by driving is without doubt one of the factors in producing the disease in such cases. Even cattle from the extreme south often succumb when exhausted by long journeys. Similar facts have long been noticed with other diseases, and particularly with anthrax, cattle

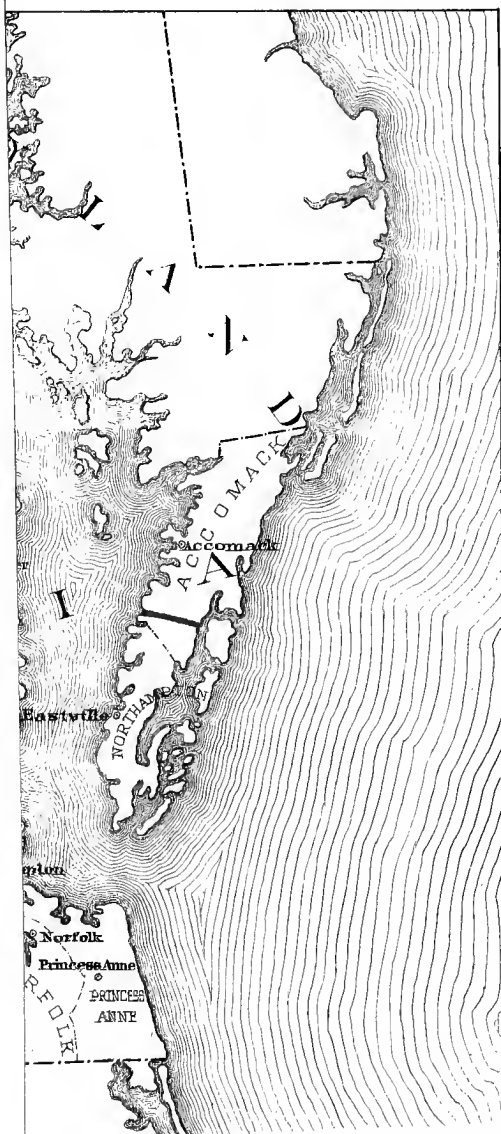
which have resisted the contagion on the infected farms becoming victims to the virus already within their bodies, when their vital resistance is lowered by great fatigue.

At Dalton there is a probability that permanent infection existed before the war, but not to the same extent as at present. The cattle driven from South Georgia to provision the armies, and later those brought by the refugees returning to their homes, are believed to have been the means of distributing and intensifying the contagion throughout Northwest Georgia.

TENNESSEE.

The line of the infected district crosses the boundary line between Georgia and Tennessee near the western slope of the mountains, and follows a northwesterly direction to Parkville and Benton, in Polk County; then its direction is nearly directly west to Cleveland, Bradley County, and to Snow Hill and Harrison, in James County. From this point the river becomes the line across Hamilton County, Chattanooga and the Chickamauga Valley having been infected for a long time. The southwestern part of Polk and the southern parts of Bradley, James, and Hamilton Counties are, therefore, permanently infected. The district infected is here, as we have found to be the case elsewhere, extending slowly toward the north; and though this extension is slow it is apparently continuous, and the territory once overrun is seldom redeemed from the scourge. The points which we have mentioned as existing on the border line of the district have only been infected within a few years, and, as elsewhere in newly infected sections, it is the commons rather than the farms that are dangerous, and even the commons are not uniformly affected.

In Marion County the line of infection passes in a northwesterly direction up the east side of the Sequatchie Valley and within one or two miles of the Sequatchie County line, and then crosses the valley and down the west side for five or ten miles, passing around the mountain range and taking a southwesterly direction to the vicinity of Jasper; from here the direction is again northwesterly to Decherd, in Franklin County, the greater part of this county being apparently permanently infected. From Decherd the direction of the line is slightly south of west to Fayetteville, in Lincoln County, and from this point along the Elk River to the Alabama State line in the vicinity of Veto Station. The southern part of Lincoln County is what is called the barren region, and has been infected for many years. In the vicinity of Marbut's the line again crosses into Tennessee, taking a northwestern direction, and at the county line between Giles and Lawrence Counties is about five miles north of the Alabama State line. On the boundary between Lawrence and Wayne Counties this line is 10 miles north of Alabama. At this point there is a sudden bend toward the north, the line crossing to the northwestern corner of Wayne County, taking in about one-fifth of



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Decatur County and all of Harden. In Henderson County it reaches as far north as Shady Hill, then passes directly west to the vicinity of Mifflin, in the same county. From here the direction is slightly south of west to Denmark, the boundary between Madison being crossed 2 miles north of Hardeman County; from here the direction is westerly to Stanton Depot, in Haywood County, and onward toward the southwestern corner of Haywood and along the northern boundary of Shelby to the Mississippi River. All of Shelby and Fayette Counties appear to be infected, while Tipton, as far as we have been able to learn, is free from any infection.

This concludes our examination of the district permanently infected with southern cattle fever for the year. It will be seen that a considerable portion of Tennessee has already become infected. Even the mountainous counties in the southeastern part of the State have been invaded, while in the river valleys of the central part of the State the line has reached considerably farther toward the north. Along the whole line of the infected district in this State, as in the other States previously examined, we have found the same history of the extension of of the permanently-infected district. At some points this extension has been insignificant or is scarcely noticeable within the last quarter of a century, but in the situations more favorable to the progress of the disease there has apparently been a regular advance of from one to four miles per year. This history coincides substantially with what was learned of the progress of the disease in Virginia, North Carolina, and Georgia. As a consequence of these facts there can be no longer substantial reason to doubt the continued extension toward the north of the district permanently infected with this disease. Considering the extreme temperature which occurs in the mountains of southeastern Tennessee and in the part of this State located in the Mississippi Valley, we can scarcely hope that the winters in any considerable part of the stock-raising section of the country will be sufficiently severe to prove a permanent check to the extension of this contagion.

It is proposed to continue the examination of this district across Arkansas, Indian Territory, and Texas, to the Rio Grande River, and it is believed that a definite location of this line will be of great assistance to those engaged in the live-stock industry in the whole southwestern part of the country. The mortality among thoroughbred cattle taken south of the border line of the permanently infected district is so great that it has become a matter of importance to buy animals which have acquired a certain amount of immunity from this disease. It is believed by many breeders that by establishing breeding farms just within the line of infection that there will be a smaller mortality from the disease, and that the animals raised under these conditions will still be able to resist its effects in a very perfect manner. Already such farms have been established in Southeast Kansas and Southern Missouri, under the belief that animals raised in this locality will prove insusceptible to the disease

when carried further south, but the great uncertainty which at present exists with regard to the exact location of this line makes it extremely doubtful if these farms have been correctly located. A number of extensive breeders who have a very intelligent idea of the nature and effects of this disease have recently expressed to me their high appreciation of the work now being done by the Department of Agriculture toward establishing the boundary of this infected district. It is believed that definite knowledge in regard to this will relieve them from many of the causes of embarrassment connected with the shipment of thoroughbred cattle to the South.

INVESTIGATIONS OF SWINE PLAGUE.

In a communication of M. Pasteur to the Paris Academy of Sciences (*Comptes Rendus*, 1883, p, 1163) it was asserted :

1. That the microbe of swine plague is a dumb-bell micrococcus.
2. That pigeons are very susceptible to the virus, and passing this through a succession of these birds increases its activity.
3. That rabbits are also susceptible, and passing the virus through a succession of these animals attenuates it to such an extent that if pigs are inoculated with it they only contract a slight illness which grants them immunity from subsequent attacks.

To these assertions Dr. Klein (*Vet. Jr.*, 1884, July, p. 39) replies :

1. That M. Pasteur has overlooked the true microbe, and that this is a bacillus and not a micrococcus.
2. That all of his (Klein's) inoculations of pigeons with virus taken directly from diseased swine—virus which invariably produces the disease in swine and other susceptible animals—and with his artificial cultures of the organism of swine fever, produced absolutely no effect, either general or local.
3. That it is impossible to say whether M. Pasteur's rabbits died of swine fever or of septicæmia, though he (Klein) had shown in 1877 that rabbits are susceptible to swine fever when inoculated from material directly derived from the pig.
4. He adds in an addendum that he has recently satisfied himself that the artificial cultivation of the virus in the organs of mice or rabbits by inoculating these from diseased swine will produce a mild form of swine plague from which the animal quickly recovers, and is thereby protected from the disease.

It is very evident that before any safe method of protective inoculation or vaccination can be adopted we must be satisfied as to the nature of the virus. Rabbits and mice are both subject to septicæmia, and it is quite certain, from the difference in the microscopical appearance of the germ described by these two investigators, that either the one or the other had cultivated and inoculated with a septic virus. Dr. Klein

does not hesitate to say that it seems probable to him that, "as in the case of the microbe of fowl cholera, M. Pasteur did not work with pure cultivations of the microbe of swine fever." M. Pasteur will doubtless say, on the other hand, that Dr. Klein has evidently been cultivating and inoculating with the septic vibrio. Both cannot be right in their belief that they have been working with the true germ, and, consequently, it is very probable that both sets of hogs were not protected from the genuine swine plague. Each has made many inoculation experiments, each has cultivated his germ through a number of cultivations in purity as he supposes, and each believes that he has produced the true swine plague with such cultivations; but one of them is wrong; vaccination with the virus of one will fail in practice, and if the wrong virus is so easily obtained it becomes doubly important to know how to discriminate between them.

In former reports I have given details of experiments which, if correctly stated, demonstrate beyond question that the microbe of swine plague is a micrococcus. These experiments were made and the accounts of them published in advance of those of M. Pasteur, and the evidence furnished was all that could reasonably be required to decide a scientific question of this kind. Dr. Klein, however, has published evidence which on its face is equally conclusive in his favor; and as it is not likely that two different diseases resembling each other so closely in symptoms and lesions, but having such dissimilar virus, have been investigated, the most reasonable conclusion is that one is mistaken in his conclusion. It is necessary, therefore, to review certain points in the investigations and to bring forward such new evidence as shall be required to remove these uncertainties.

1. *The microbe of swine plague.*—As I have shown elsewhere (*Science*, 1884, p. 155) Dr. Klein was first to demonstrate the presence of micrococci in the tissues of animals that had suffered from swine plague, but he did not at that time (1876) attribute, nor has he at any time subsequently attributed, the cause of the disease to this organism. On the contrary, he published a long series of investigations in 1878 (report of the medical officer of the Local Government Board) from which he concluded that the true germ of this disease is a bacillus, and in his last paper reiterates this conclusion and asserts that the micrococcus is entirely an epiphenomenon (*Vet. Journal*, July, 1884, p. 39-47).

In my report for 1880 (Department of Agriculture, Special Report No. 34, pp. 22-24), I published experiments showing that the blood of sick, not dead, hogs, which had been received into vacuum tubes that were thrust inside the vein with proper precautions before being opened, and were then immediately withdrawn and hermetically sealed, contained micrococci and no other organisms, and that hogs inoculated with this blood contracted a severe form of swine plague. This organism was found to exist in the virulent liquids (blood, peritoneal effusion, &c.), in three distinct outbreaks of the disease which were investigated at that

time. This was the first discovery recorded, so far as I am aware, of the existence of micrococci in the blood of the affected swine before death; and it has a very important bearing on the etiology of the disease, since a *post mortem* development of the germs is out of the question and they were found in situations to which there was no direct communication from the outside of the body.

In my next report (Department of Agriculture, Annual Report, 1881 and 1882, pp. 267-269) I gave the details of experiments which demonstrated that these micrococci after they had been carried through six cultivations in considerable quantities of liquid were still capable of producing very marked cases of the disease. This was, I believe, the first satisfactory evidence of the pathogenic effect of the micrococci in the disease known as swine plague; and I desire to call attention to the fact that these inoculations were made January 17, 1881, or more than fourteen months before the discovery of the same organism by M. Pasteur and Thuillier.

To establish the connection of the bacilli with the cause of the disease, Dr. Klein relies upon the following evidence:

1. The presence of bacilli in microscopic sections of the tissues.
2. The multiplication of bacilli in the artificial cultures of the virus.
3. The production of disease by inoculations with the cultivated bacilli.

He has not forgotten that in his first report he described micrococci and not bacilli as existing in the tissues, but there is an evident attempt to explain this by conveying the impression that these were found exclusively in situations where they might be derived from external sources. For instance, in his last paper (*Vet. Journal*, July, 1884, p. 41) he says:

Preparing sections through the typically ulcerated mucous membrane of the large intestine, staining these in aniline dyes, and examining them under the microscope, I find this: In the superficial parts of the necrosed membrane are present large numbers of micrococci of various kinds, chiefly varying in the size of the elements and in the mode of aggregation. These micrococci stain well in Spiller's purple and in methyl blue, and are present only in the necrotic parts of the ulceration, in which they appear irregularly distributed. But in the depth of the tissue, and extending in many cases into the inflamed sub-mucous tissue, are seen streaks and clumps of minute rod-shaped bacteria, which coincide as regards size (length and thickness) with the bacilli which I described in my former memoir, the single organisms being about 0.001 to 0.004 ^{mm}. long, and about a third or a fourth as thick.

In his first report he described the situation of the micrococci in the intestine somewhat differently, as follows:

From, and even before the first signs of necrosis of the mucosa, viz., when the epithelium begins to break down and be shed from the surface, there are found masses of micrococci, which in some ulcers occupy a great portion of débris. (Report of the medical officer of the privy council and local government board, 1876, p. 98.)

Again, in regard to the ulcerations of the mucous membrane of the tongue, he says in his last report:

I have seen in the superficial parts of the ulcers large clumps of micrococci, but in the depth of, and extending between the inflamed muscular tissue I have found the

same rod-shaped organisms as mentioned above; they are chiefly in spaces between the bundles of the inflamed connective tissue, forming here streaks of longer or shorter chains. (Page 42.)

In his first report this was stated as follows:

In the ulceration of the tongue just mentioned, and at a time when the superficial scab has not been removed, I have seen masses of micrococci situate chiefly in the tissue of the papillæ, but at some places reaching as far deep as the inflammation extends. (Page 99.)

In regard to the similar lesions of the epiglottis the following language was used:

I have before me preparations through the epiglottis, the submucosa of the posterior surface being in a state of necrosis, and near the edge so broken down as to leave there a deep ulcer, while the mucous membrane of the anterior surface is only slightly inflamed in its submucous tissue; in this I find lymphatic vessels filled with micrococci, &c. (Page 100.)

As to the appearance of the lung his last report says:

Sections through the diseased parts of the lung reveal, in preparations stained as above, the presence of large numbers of micrococci in the cavity of the bronchi and air vesicles, but not in all lungs, since I have found lungs in which they were altogether absent. But there are always present in larger or smaller clumps the same minute rod-shaped organisms as mentioned above. They are imbedded in a coagulum filling the air vesicles, or they block up a blood-vessel in the wall of a bronchiole or air vesicle. In the air vesicles I have seen exudation cells, white-blood corpuscles containing clumps of the rods; they are well brought out by Spiller's purple. In the air vesicles of some lungs I have seen them grow to very long chains, leptothrix, ten, twenty, and more times the length of the single rods. These rods were present, not only in the air vesicles, but also in the tissue itself, both of the walls of the air vesicles as well as of the smaller or larger bronchi. (Pages 41, 42.)

In his first report there is a most radical difference in the description of the situation where the micrococci were seen:

In the infiltrated, firm, more or less disintegrating parts I find great masses of micrococci filling up capillaries and veins, and also contained in lymphatics around arteries. They may be found also in minor bronchi which have been completely blocked up by cheesy inflammatory products, but there the masses of micrococci, conspicuous by their blue coloration in hæmatoxylin preparations, are generally present in greater or smaller lumps between the outer surface of the plug and the wall of the bronchus.

The pleura is much swollen, and contains great numbers, continuous layers, of lumps of micrococci. The free surface of the membrane is in many parts covered with them. The exudation fluid is also charged with them, as has been mentioned above. (Pages 100, 101.)

That is to say, in 1876, Dr. Klein was able to find the micrococci not only in the necrotic parts of the ulcerations, but he found them *from and before the first signs of necrosis*; he found them *extending as deep into the tissue of the tongue as the inflammation extended*, and in the epiglottis *at a point where the submucous tissue was only slightly inflamed he found the lymphatic vessels filled with micrococci*. In the lungs, instead of the micrococci being confined to the cavity of the air vesicles and bronchi, as he desires us to understand from his last report, he really found them *in the infiltrated and firm parts, filling up capillaries, veins and lymphatics*. They had even penetrated to the pleura *which contained great numbers*

and continuous layers of them ; the free surface was covered with them, and the exudation fluid was charged with them. Their presence in the pleural effusion is sufficient evidence that cross-section of bacilli had not been mistaken for micrococci in the tissues; and it may, consequently, be accepted as beyond question that this organism existed at the points named in the report of 1876.

In the last report it is stated that the rods (bacilli) are found "in the bronchial exudation, in the juice of the lung tissue, in the peritoneal exudation, and occasionally, but not generally, also in the blood already in the fresh state." Sections made through the fresh or hardened, swollen mesenteric and inguinal lymph glands are said to reveal the presence of clumps of the same minute rod-shaped organisms. Looking at a clump of these organisms, one imagines them at first to be a zooglœa of micrococci, but using oil-immersion lenses and Abbe's sub-stage condenser it becomes certain that they are undoubted rods—some smooth and uniform, others more or less "beaded."

In the results of the examination of the tissues it will be seen that, with the exception of the lymph glands mentioned, the bacilli of the last report have little if any advantage in situation over the micrococci of the first report. And if we consider that the organisms of these glands so closely resemble micrococci that it requires oil-immersion lenses and an Abbe condenser to make a distinction, and that even under such favorable conditions some of the rods are more or less "beaded," the reader will not feel so certain that they are undoubted rods as is Dr. Klein.

The examination of the tissues of mice and rabbits which have died after inoculation with the more or less septic liquid of dead hogs cannot be accepted as throwing any satisfactory light on so difficult a problem, since others cannot fail to have the same doubts in regard to Dr. Klein's experimental animals that this gentleman is so free to express in regard to those of M. Pasteur. The question as to the organisms found in the tissues of animals so susceptible to various forms of septicæmia as mice and rabbits after they have been inoculated with morbid products from hogs which have died of a disease in which local necrosis and gangrene is not uncommon, is one which can only complicate the real issue without in any sense elucidating it. Indeed, when Dr. Klein tells us that he has "seen a good many pigs inoculated with culture of the bacterium of swine fever, which beyond the swelling of the glands and beyond a transitory rise of the body temperature on the second and third day, by one or even two degrees C., showed no other signs," we have strong suspicions that the slight trouble produced was of a septic nature rather than a mild attack of the destructive swine plague. The period of incubation in swine plague is much longer than that of septicæmia; sometimes it is three weeks; generally it is from twelve days to two weeks, and it is only by the use of enormous doses of virus that I have succeeded in reducing it to four or five days; and, therefore, when we are told that in these

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mild attacks the period of incubation was but two or three days, and that in at least one case there was a rise of temperature within twenty-four hours (*Ibid.*, p. 43), the appearances are certainly very much more in favor of septicæmia than swine plague. Certain it is that in none of my numerous inoculation experiments has there been a rise of temperature within so short a time. As I write this I have just returned from making a *post mortem* examination of a pig killed in the last stages of the acute form of the disease; this was one of a lot of three inoculated with a virus so virulent that not one of a considerable number of swine that have been inoculated with it during the last three months has recovered. With so virulent a virus one would expect the incubation to be at its shortest duration, and yet neither of these three showed any appreciable signs of disease up to the twelfth day. All sickened at about the same time, and to-day, the fifteenth day, all were so extremely ill that the most careful prognosis would be death of all within forty-eight hours.

In animals which have died from the disease and on which a *posts mortem* examination was not possible immediately after death, I have also found bacilli in the peritoneal and plural effusion, and even in the blood. A photograph of some of the peritoneal effusion dried on a cover-glass at the time of the autopsy, and afterward stained and mounted, shows these very plainly; this photograph has been reproduced by the heliocaustic process and accompanies this report as Plate XII. No doubt bacilli would also have been found in the solid tissues of this animal; but these organisms were the result of changes which occur either shortly before or after death, and have not been found in any of the numerous animals which I have destroyed for examination when in the earlier stages of the disease. In such cases the peritoneal, the pleural, and the pericardial effusions, and usually the blood are found to contain motionless micrococci of the figure-of-eight form, but often united in chains and various-shaped clusters.

In the many cultivations which I have made from material obtained from slaughtered animals I have never found bacilli except in a very few cases where the virus was not obtained until after contact with the air, where the vacuum tubes had not been properly sealed, or where the animal was not slaughtered until the last stages of the disease. A photograph of a preparation made from one of these cultivations is reproduced in Plate XI. It seems to be a perfectly pure cultivation of micrococci so far as careful examination with the microscope is able to determine, and it was so virulent that three pigs inoculated with it all contracted the disease and all died.

In my most recent investigations I find that the peritoneal effusion is often impure in the last stages of the disease. In such cases a variety of organisms appear in the cultivations made with this liquid, but pure cultures of micrococci are still obtained from the pleural effusion, or in those rare cases where this too is impure the pericardial fluid and

blood have yielded pure cultures of micrococci. A fact of great importance is that no pure cultures of bacilli have been obtained, and that where but a single species of organism has multiplied this has invariably been a micrococcus.

Having obtained such results from my investigations, and having repeated them over and over again, and confirmed them with virus from various parts of the country, I cannot but conclude that swine plague is due to a micrococcus, and that the disease produced by Dr. Klein's cultivated bacilli was a form of septicæmia. And this conclusion is confirmed by the short period of incubation in his cases, and the fact that many of his animals showed no signs of disease other than a slight rise of temperature and an enlargement and congestion of the lymph glands.

The following record of experiments contains the most important of those which have been made since my last report, and is a continuation of the evidence upon which the above statements have been made:

Experiment No. 1.—Two pigs were inoculated June 28, 1883, with virus dried on quills and sent from Indiana. It was obtained by killing a sick pig and immediately dipping the quills in peritoneal and pleural effusion and the exudation liquid from the lungs, and drying this after the manner practiced for preservation of vaccine lymph. In this case the animal from which the virus was obtained did not have a very severe form of the disease. For inoculation the virus on three or four quills was rubbed up with 2^{cc.} of salt solution and injected under the skin of thigh. The fourth day (July 2) there was elevated temperature ($102\frac{4}{5}^{\circ}$ and $103\frac{1}{5}^{\circ}$ F.) and slight redness at the point of inoculation. The fifth day there was diffused redness on the inner side of both thighs, an eruption of small papulæ on the thin parts of the skin and an increased elevation of temperature ($103\frac{2}{5}^{\circ}$ and $104\frac{4}{5}^{\circ}$ F.). July 5 to 9 the temperature remained at or above 105° with one, and reached its highest point on the 7th, being then $105\frac{3}{5}^{\circ}$, and the eruption was very plain and extended over the greater part of the surface of the body. From this time they began to improve, and in neither case was the disease fatal.

This was one of a number of inoculation experiments made to obtain a reliable virus for experimental purposes, and is recorded to illustrate the above remarks in regard to the period of incubation.

Experiment No. 2.—Four hogs were inoculated July 7, with virus also from Indiana, and preserved in the same way as the other, but was obtained from an outbreak which was much more virulent and fatal. This was also suspended in salt solution and injected hypodermically in the dose 2^{cc.} to 3^{cc.} at the inner side of the thigh.

To and including July 17, or for the first ten days, there were small, hard swellings at the point of inoculation, but no positive signs of disease, and the appetite remained good. There were considerable variations in the temperatures, but it is doubtful if this had any pathological sig-

nificance. July 18, three were evidently sick, with temperatures of $102\frac{3}{5}^{\circ}$, $105\frac{1}{5}$, and $106\frac{3}{5}^{\circ}$ F.

The one most severely affected was killed July 21, at which time the temperature was $104\frac{3}{5}^{\circ}$ F., and there was complete loss of appetite. The point of inoculation was much swollen, the enlargement extending forward under the abdomen, and was about 6 inches in length by 2 in breadth. When cut across it was found to be dense and fibrous and creaked under the knife. A clear lymph flowed from the cut surface. In the center of the swelling was an irregular cavity, 1 to 2 inches across and partly filled with dry caseous material, reminding one of the sequestrum formed in fowl cholera when an inactive virus is injected into the muscles in large quantities. The right lung was nearly all of a deep-red color with extensive areas of infarction. There was a small quantity of effusion in the cavity of the thorax. The intestinal tract was congested but there was no peritoneal effusion.

The pleural effusion was collected in vacuum tubes with all known precautions to prevent access of atmospheric germs, and hermetically sealed. Cultivations were made by infecting sterilized nutritive liquids in the cultivation apparatus with small quantities of this pleural effusion. The cultivation liquids used were pork and beef broths which had not been neutralized and neutral veal broth. All the attempted cultivations were successful, and the organism which multiplied was of identical appearance in each—it was a diplococcus or figure eight in form, and had a tendency to adhere in short chains and small clusters.

This organism was carried through three cultivations, each apparatus containing about half an ounce ($15^{\text{cc.}}$) of liquid. August 2 experiment No. 3 was made by inoculating 2 pigs with the third cultivation of this micrococcus. One of these had a hypodermic injection of $4^{\text{cc.}}$ and the other of $10^{\text{cc.}}$ of the cultivation liquid. This was made on the inner side of both thighs and with the latter also between the fore legs.

There was swelling at the point of inoculation within twenty-four hours; but no marked increase of temperature until August 7, when it reached $105\frac{1}{5}^{\circ}$ with one, and $104\frac{2}{5}^{\circ}$ with the other, with impaired appetite, thirst, and shivering. Two days later the skin over the entire abdomen was wrinkled, flabby, and in places losing its epidermis. From this time they improved in general symptoms until August 17, when the one that received the larger quantity of virus and which had been most severely affected was killed for examination. At this time there was extensive desquamation of the epithelium over the abdomen; the swelling at the point of inoculation had softened and contained pus. There was swelling of the lymphatic glands of the inguinal and mesenteric regions, petechiæ of the serous membranes, and slight peritoneal effusion.

Experiment No. 4.—Three pigs, Nos. 26, 27, and 28, were inoculated June 9 with a cultivation liquid seeded from the virulent effusion of a

pig that had died from the result of inoculation with a very fatal virus received from Illinois. This cultivation liquid contained only micrococci, the appearance of which are very well shown in Plate XI, which was reproduced from a photograph.

June 14, all had elevated temperatures varying from 104° to $105\frac{2}{3}^{\circ}$ F., increased thirst, tucked up abdomens, swelling at the points of inoculation, rigors, and secluded themselves in their bedding. The appetite was still fair.

June 20, there was complete loss of appetite, emaciation, and profuse diarrhea.

June 29, No. 27 died, and autopsy revealed congestion of intestines, hepatization of right lung, with abundant effusion in the pleural, pericardial, and peritoneal cavities. Inoculations with this effusion caused death of another pig July 8, after showing the well-known symptoms of swine plague.

July 3, No. 28 was found in a dying condition and was destroyed, in order to get fresh material for examination and for inoculation experiments.

July 6, No. 26 died in convulsions after having presented the characteristic symptoms of the various stages of swine plague.

The notable point in this experiment is the virulence of the cultivated virus. This virus was a pure cultivation of micrococci and produced fatal results in every case. The results of our inoculation experiments with cultivated micrococci have heretofore been more or less unsatisfactory, because, while the symptoms were those of swine plague, the disease produced did not correspond in its malignancy to the swine plague which so frequently decimates the herds of the West. In this case, however, the disease developing as a result of inoculation had all the malignancy of the most severe outbreaks which I have ever witnessed, and in subsequent experiments with virus obtained from these animals this fatal type has been retained and every animal inoculated has succumbed.

On July 3, pig No. 34 was inoculated with mixed pleural and peritoneal effusion obtained from No. 28, which was killed that day in the last stages of swine plague, produced by inoculation with cultivated virus as detailed above. July 15, the temperature was 104° F., and there were periods of shivering. From this time the progress of the attack was rapid; there was a red blush of the skin over the abdomen, diarrhea, loss of appetite, prostration, and tendency to hide in the litter. July 18, it was very much debilitated, the breathing was rapid, and it was scarcely able to walk. It would undoubtedly have died in a few hours. It was killed for examination and for pure virus.

Autopsy showed the lungs to be covered on pleural surface with petechiæ, but there was no hepatization. The inguinal and mesenteric glands were greatly enlarged and congested; the small intestines inflamed; the cæcum was the seat of three large ulcerous patches, 1 to 2 inches in diameter, and several of smaller size. These were black

on the surface and on sections the tissue appeared dense, fibrous, and pale. The ileo-cæcal valve was completely covered with such an ulcer, and the mucous membrane of the stomach was much congested.

Thoroughly sterilized vacuum tubes were filled from the jugular vein, from the right ventricle, and with the pericardial and peritoneal effusion, each of which were abundant. At the time of the autopsy small quantities of each of these effusions and of the blood were dried on cover-glasses for examination in the laboratory.

The tubes of peritoneal fluid when opened emitted a very disagreeable odor of putrefaction. Stained cover-glass preparations showed that it contained both micrococci and rods. Cultures of the same contained micrococci, a bacillus with pointed ends, probably the *Bacillus butyricus*, and a few rods of bacterium termo. From this result it becomes an interesting question to learn if these various organisms really existed in the peritoneal liquid at the time of the animal's slaughter, or if they were introduced from the atmosphere during the necessary manipulations for filling and sealing the vacuum tubes. In other words, is it possible for septic bacteria, in diseases which produce lesions of the intestines, to penetrate the walls of these organs and multiply in the peritoneal effusion before the death of the animal? In a former report (Annual Report Department of Agriculture, 1880, p. 432), I have collected a number of observations which seem to answer this question in the affirmative. Fortunately in the case under consideration examinations were made which furnish satisfactory evidence that there were various forms of bacterial organism in the fluid of the peritoneal cavity before the death of the animal. Preparations were made by thoroughly drying this fluid on cover-glasses as soon as the abdominal cavity was opened, and in these, of course, there could be no change before examination. Such preparations stained and mounted demonstrate conclusively that while the micrococci predominated, there were also present a considerable number of bacilli. These observations, which were made with the greatest precautions to avoid errors, go far to reconcile the discrepancies which have appeared to exist in the results of the various investigations of this disease.

Cover-glass preparations of blood from the jugular presented no definite bacterial forms even after staining. Cultures of this blood remained perfectly sterile.

The pericardial effusion contained large numbers of micrococci, easily seen both in unstained and stained preparations. Cultivations gave pure growths of micrococci.

The blood from right ventricle showed aggregations of micrococci, and cultures of this blood produced a pure growth of the same organism.

Sections of the cæcal ulcer contained enormous aggregations of micrococci in the depths of the cavity; the necrotic portion appeared to consist almost entirely of these bodies. In some sections small colonies.

of micrococci were found in the deeper parts of the tissue. No rods could be found even in sections stained with fuchsine, a stain which Klein used in his investigations.

In sections of the spleen, stained in various ways, no organism could be detected.

Sections of the most congested mesenteric gland revealed no organisms within the gland tissue, but the peritoneal surface and its serous covering were studded with micrococci, interspersed with which might be seen a considerable number of large and small rods.

Pig No. 39 was inoculated July 17, and was slaughtered August 11, being at that time very severely affected, and presenting well-marked symptoms of swine plague. The mesenteric vessels were congested, as were those about the ileo-caecal valve, but there were no ulcerations at this point. The lungs were pale, but contained a number of dark-colored congested patches. There was no pleural effusion; the pericardial cavity contained a considerable amount of liquid, and there was also slight peritoneal effusion.

Cultures of the pericardial fluid gave a pure growth of micrococci. The vacuum tubes, filled with peritoneal fluid, were preserved until September 2, and were then found to contain large numbers of micrococci, but no other organisms.

A large number of observations similar to the above have been made, and in all cases where a pure cultivation has been obtained the organism which multiplied was a micrococcus, and when the virulence of such cultivated micrococci has been tested by inoculation experiments typical and fatal cases of swine plague have resulted.

Respectfully submitted,

D. E. SALMON, *D. V. M.*



SWINE PLAGUE MICROCOCCI.
Photo micrograph of cultivation liquid X 450.



SEPTIC BACTERIA.

Photo-micrograph of Peritoneal Effusion.

ERGOTISM AMONG CATTLE IN KANSAS.

Hon. GEORGE B. LORING,
Commissioner of Agriculture :

SIR : In obedience to your telegram of the 5th of March, requesting me to go to Neosho Falls, Kans., and there to investigate a disease among cattle, I forthwith prepared myself and left on the 6th, arriving at Neosho Falls in the afternoon of the 8th. On my way to Neosho Falls I was delayed overnight at Burlington, Kans. On the same evening I read a report in the *Kansas City Journal* of a meeting which had been held at Neosho Falls on the evening of the 6th attended by his excellency Governor G. W. Glick, Lient.-Gov. D. W. Finney, who, in company with other State officials, Dr. A. A. Holcombe, D. V. S., of Leavenworth, Dr. Wilhite, of Emporia, and a number of stockmen, had by special train proceeded to Neosho Falls, and investigated the disease among cattle in Woodson and Coffey Counties, and upon the authority of Drs. Holcombe and Wilhite said disease was pronounced to be the contagious foot-and-mouth disease. At the meeting in the evening a quarantine committee was appointed, with Lieutenant Governor Finney as the chairman. This committee was instructed to quarantine all infected cattle and premises, to guard against further diffusion of the dread disease. Upon reading this article I was greatly surprised and alarmed. I had no reason to doubt the correctness of the diagnosis by Dr. Holcombe, whom I knew from personal knowledge to be a very competent veterinarian.

On my arrival at Neosho Falls, Woodson County, late in the afternoon of the 8th, I was met by Lieutenant-Governor Finney and Dr. Holcombe, who immediately procured a conveyance and accompanied me to the residence and farm of Mr. Daniel Keith, situated in the southeast corner of Coffey County, 5 miles north of Neosho Falls. Here I was conducted to a small pen or inclosure which contained 12 head of yearling calves. This pen measured about 40 by 60 feet, and was inclosed on two sides by a rail fence, by a hay rack and corn crib on the west side, and horse stable and corn crib on the east. The pen was well bedded with hay and straw. On entering the inclosure I walked along the hay rack and gave the hay a hasty examination, but found it clean, bright, and sweet, it being wild hay made on bottom lands. I also looked for ergot among the grasses which composed the hay, but discovered only two or three heads of wild rye which were ergotized ;

the amount being insignificant I gave it no further thought at the time. My expectation, after reading a description of the symptoms of the disease among the cattle, was to discover ergotism, should the disease prove not to be the genuine foot-and-mouth affection. I inquired if any of the pregnant cows and heifers had aborted, and was told they had not; but my attention was called to one white cow, six years of age, which presented many ulcers on the udder and teats. These ulcers, according to the description of Mr. Keith, first appeared as vesicles or blisters about three weeks previous, but at the time I saw her they were covered with scabs, and were healing off. Mr. Keith stated that this cow was suckling a ten day's old calf when she first evinced symptoms of the disease, and that two days thereafter the calf died, having succumbed to a severe diarrhea.

The yearlings in the pen presented the following conditions: Four of them had lost both hind feet, the separation taking place at the fetlock joints; 5 had each lost one hind foot; and 3 were about to lose both hind feet. The latter cases presented a well-defined line of demarkation at or above the fetlock joint, extending and encircling the limb in a straight or slightly oblique line; the upper parts of said line presented a healthy surface, discharging a small amount of landable pus, and were healing under a scab; the limbs below this line were perfectly devitalized and shrunk in a dry gangrenous condition. In the clefts of several of the feet I found considerable evidence of previous ulceration, and loosening of the walls of the foot around the bulb of the heel. Those animals which had lost their feet were apparently in a healthy condition, a slight elevation of temperature being the only appreciable evidence of functional derangement remaining, aside from the crippled limbs. They ate well; licked themselves; the stumps were scabbing over and healing; they occasionally got up and hobbled along for a few steps, then dropped down.

I next examined their mouths, which revealed denudation of the mucous membrane and discolored patches on the nose, lips, tongue, and roof and elastic pad. In some of them only two or three of these discolored spots would be found on the lips, pad, or the roof of the mouth. The discolored or denuded patches did not extend deeper than the submucous connective tissue, and presented a brownish yellow or rusty color; they were irregular in outline, and of various dimensions, from the size of a pencil's point to half an inch in diameter, and were not circumscribed by any reddish or inflammatory border.

No soreness or inconvenience was manifested in the act of eating. Temperatures ranged from 102° to 103.8° F. I saw a number of other cattle in various stages of lameness, also some which had recovered from lameness, yet no very recent cases were reported by Mr. Keith, from whom I received the following brief history:

He first became aware of the trouble among his cattle on or about the 23d or 25th of December last, when he noticed a peculiar jerking up of

the hind legs among a number of the calves. They would first jerk up one foot and then the other, or shake the foot as if they wanted to shake off a foreign body, and acted as if they could not place the affected foot to the ground. They would then hobble along a few steps, and walk off moderately well or lie down. When they stood quiet they arched the back and dropped the head.

Some of them slobbered or frothed at the mouth, and would not eat hay very well. In the course of two or three days they persisted in lying down nearly all the time; swelling about the coronet then became apparent, extending as high up as the fetlock, or even higher in some cases, which was attended by great heat and tenderness.

Soon after this swelling appeared—a very few days—a band around the leg would then appear, the skin becoming contracted, dry, and hard; next the skin broke and a sore made its appearance. This sore encircled the leg and gradually deepened until complete separation of the limb at one of the joints occurred. The time consumed from the first appearance of the disease until the final dropping off of the dead portion of the limb would be from three to four weeks. In some cases he noticed soreness and ulceration in the clefts between the claws. When he first noticed the jerking up of the feet and limbs he thought it was due to impaction of mud between the claws; therefore he examined some of the feet, but found no impactions. On the 1st of January about 30 head of the calves manifested lameness. All of these calves were fed upon wild hay and shelled corn during the fall and winter. All the medical treatment which these cattle received was one application of muriatic acid around the limb where the line of soreness existed. The described 12 head of yearling calves, and 51 more of the same age, he bought from Mr. J. Davis on the 11th of December, and took them home on the 12th. Mr. Davis had bought these calves from different parties within a radius of 10 miles south and east of Neosho Falls.

Leaving Mr. Keith's place, we went to the farm owned by Mr. A. C. Goodrich, which is occupied by Mr. Edward Hindman, who is the overseer of the stock on the farm. The Goodrich farm is divided from the Keith farm by a public road running north and south. On the Goodrich farm we saw 20 head of cattle, all of which were two years old and upwards, which had then lost or would eventually lose one or more feet, or parts of them, and 2 of them were about to lose all their feet.

In one of these cases the line of demarkation was 6 inches above the fetlock, and in the other 4 inches, while some of them had lost only one claw or one foot at the second joint. All of these cattle presented greater or less discolorations, erosions, or ulcerations on the lips, tongue, or roof of the mouth, and in several the mouth lesions were much more prominent than in any of the Keith cattle. A two-year old red and white steer, which had lost both hind feet at the fetlock joints, presented, upon examination of the mouth, brownish yellow-patches on

the roof, covering two-thirds of the space between the pad and soft palate. These patches coalesced and were elevated one-sixteenth of an inch, possessed a well-defined border and a flattened surface. On the pad were two large oval or oblong ulcers, one of which measured an inch and a quarter in length. On the gums of the lower jaw, inside of the lateral and corner-incisor teeth of the right side, appeared one large ulcer, which possessed a more reddish and inflammatory appearance than those on the pad. On the right side of the thick portion of the tongue existed an ulcer which had an excavated bottom and a greasy and dirty-looking appearance; this was $1\frac{1}{2}$ inches in length and of an oval shape. Temperature 103.8° F. A two-year-old red heifer, which had lost one hind foot at the fetlock joint, and the other was in process of separation at the same place, presented a mouth with lesions exactly similar to the first one, only that they were confined solely to the roof of the mouth.

A third case—a five-year-old cow which was losing both hind feet at the fetlocks—presented discolored patches and small erosions on the tongue, lips, and roof of the mouth, also ecchymosed spots appeared on the mucous lining of the vulva, and mucus mixed with pus flowed from the vagina. An ulcer the size of a silver dime appeared inside of the sphincter ani. Temperature 104° F. Mr. Goodrich, among his herd of 95 animals, had 21 cows and a number of heifers which were pregnant, but none of them aborted.

In an adjoining lot I saw a number of young calves; upon inquiry I received the response that these calves were all well, and had not been with the diseased cattle. A number of hogs also were inclosed in another lot adjoining that of the diseased cattle, and I was told that they had not been in contact with the cattle. Night was now approaching, and owing to the number of people which had gathered, and the excitement which prevailed, it was impossible to obtain any definite or extended history of the outbreak, manner of feeding, surroundings, &c. Therefore I deemed it best to return to town and compare notes with Dr. Holcombe, and return on the next day to make a more thorough investigation, and to obtain a full history. I was now told by some of the stockmen present that they desired to have my opinion on the nature of the disease; that they intended to have the cattle appraised, killed, and buried on the next day, if my diagnosis corresponded with that of Dr. Holcombe. Two of these parties came from Emporia for this expressed purpose.

This placed me in a very delicate and unpleasant position, as I had not given the matter the thorough investigation that I desired to do before making my diagnosis. I had to rely almost solely upon a history as given to me by parties upon whom I could not place absolute reliance; nevertheless I felt compelled to make a diagnosis under these pressing circumstances. Taking, therefore, into consideration, 1st. The history

which was given to me by Mr. Keith, which so closely described the first symptoms of the foot-and-mouth disease; the ulcers and previous vesication on the udder of the Keith cow, and the death of her calf soon after the disease manifested itself in the mother; the absence of abortions or the supervention of nervous affections which I expected to find in ergotism. 2d. Attributing the discolorations of the mouth to the remains of previous vesications; the losing of the feet as a sequelæ to foot-and-mouth disease aggravated by neglect, and exposure to intense cold. 3d. Accepting the history of a case described to me by Dr. Holcombe, where he discovered an animal on the Keith place in the second or vesicular stage of foot-and-mouth disease in which he found several distinct characteristic vesicles in the mouth, accompanied by salivation, and another vesicle in the cleft of the foot near the heel the size of a silver dime, and which he caused to rupture by a pressure with his finger, and registering a temperature of 104.4° F. 4th. Accepting as true the positive statement of Mr. J. W. Beard, who lives 2 miles south of Mr. Keith. He stated that he had exchanged cows with Mr. Keith on the 18th of February, and that two days after he brought the cow home from the Keith place one of his cows contracted the disease, and that several others followed in quick succession; (this was strong evidence to prove the contagious character of the malady); in the absence of recent cases, placing reliance upon the statement made by Dr. Holcombe, and upon his diagnosis, having no valid objections to offer to it, I was led to concur with him, and announced my belief that the disease among the cattle on the Keith and on the Goodrich farms was epizootic aphthæ. I went out to the Keith farm again on Sunday, the 9th, with the intention of obtaining a complete history of the outbreak, to examine the quality of the feed, water, and soil, to make a more extended examination of all of the diseased animals, and to make *post-mortem* examinations if opportunity afforded it. But when I arrived at the Keith place a stream of people were passing in and out among the cattle. A delegation of stockmen were there with the avowed purpose of paying for and disposing of the diseased animals, and another number of persons were holding a consultation in relation to petitioning Governor Glick, requesting him to convene the State legislature for the purpose of enacting laws and to make provision for the stamping out of the disease. These parties were monopolizing the time of the owners of the cattle, consequently I had to wait for a more favorable day to accomplish my work. This day, however, I made a more extended observation of the cattle on both farms, as I was exceedingly anxious to find a recent case. My search was rewarded by finding a red yearling steer at Keith's, which presented a blister at the anterior border of the soft palate; it was about the size of a silver dime, and had a thin raised pellicle of mucous membrane which ruptured when I touched it. Two small pointed vesicles appeared on the upper surface of the tongue. No excessive salivation

was present. A pinkish color was diffused over the membrane of the mouth and tongue. Breathing accelerated; temperature 104.5°. In withdrawing the instrument from the rectum an ulcer was exposed to view, which bled slightly. (On the following day I saw this animal again and found the conditions unchanged, except that the blisters in the mouth had assumed the characteristic brownish-yellow color, similar to those found in the mouths of the worst cases. In the course of ten days this animal had about recovered.) On this day I noticed several animals frothing at the mouth, although they showed but slight indications of lameness, but for want of proper assistance was unable to catch them for closer inspection. On the Goodrich farm I found a number of cows and heifers to have discharges from the vagina, accompanied by thickening ecchymosis, or ulcerations of the mucous membrane of the vaginal walls. I noticed also small blood-clots and mucus or recently-dropped *feces*.

On Monday, the 10th, I looked again for recent cases, but did not succeed in finding any.

Mr. Hindman gave me the following history: He has lived eight years on this place, and has been engaged in raising and feeding stock during that time. He never before had any disease among his cattle. He took into a herd 5 miles east, which was in charge of George Grant, 72 head of cattle last spring, and on the 10th of October brought home 78 head. During the summer 2 died and 5 were sold. Since the return of the 78 head 8 calves have been born. These cattle, since the 10th of October, have been kept in a feed-lot, sheltered by timber, south and east of the house. They derived their drinking water from a pond (surface water) located in a field 20 rods north of the house, and at about the same distance from the residence and yards of Mr. Keith. On New Year's week he took all the cattle, except a few cows and a bull, out of the feed-lots, driving them through a gate south of the house, and then drove them down the public road a distance of 40 rods and turned them into a stalk-field and meadow, from whence they could again return through a gap in the hedge to the old feed-lot and drinking place. He kept 3 cows and a bull in a small field north of the house, from which they went to the same pond for water as did the other cattle. On or about the 10th of January one of these milch cows became lame in one hind foot, and was yet lame when I saw her, but manifested no indications of losing any part of her foot. The next cases of lameness appeared on the 14th or 15th of February, the day after a heavy rain and sleet storm. On that morning a number of cattle were lame, and new cases appeared daily for a number of days thereafter. The lameness attacked cattle regardless of age, sex, or condition, old as well as young, and just as severely. As soon as they became too lame to get around to feed and water they were driven into a small yard on the east side of the house, where they had a covered shed for shelter, and feed and water was carried to them. In this shed

the worst cases were kept, and in the west end of it a small stall was partitioned off by a few fence boards, in which the bull was tied. This bull never manifested any symptoms of the disease. This is substantially the history which I obtained from Mr. Hindman on this day. With regard to the kind of feed which the cattle received, Mr. Hindman told me that all the cattle one year old and upwards were fed upon hay made on the bottom lands, that they depastured 30 acres of corn stalks, and lately received wheat straw in addition to the hay. The milch cows, which were kept north of the house, the bull, and the young calves received corn in addition to hay.

On a subsequent visit I was informed, either by Mr. Hindman or one of his hired men, that the hogs had been allowed to remain in the yard with the diseased cattle until they began to gnaw at their dead feet, in consequence of which they were turned into the orchard. I also discovered that the young calves had remained in this yard until they were crowded out by the rapid increase of invalids.

History.—On the 11th of December Daniel Keith bought 63 head of yearling calves from Mr. Joseph Davis, and brought them home on the 12th. Four days previous to this time he had bought 5 yearlings from Nelson Stride, 2 miles south. He bought one from William Inge, 2 miles southeast, about a week later. Bought one from Balt. King, $2\frac{1}{2}$ miles southwest of Neosho Falls, a day or two after the Inge calf. Bought one 4 miles south of Neosho Falls on or about the 10th of February, and on the 20th bought 6 head from Alex. Linn, 1 mile down the river from Neosho Falls. On or about the 23d of December he first noticed the lameness to exist among the calves which he had bought from Mr. Davis, and described their actions and symptoms as stated in the early part of this report, but he also stated now that in the commencement of the disease many of them slobbered profusely; numerous small blisters appeared in the mouth and on the tongue, and that they then refused to eat hay or rough feed; that they manifested an inclination to lie in the snow, and on warm or sunshiny days they sought cool and sheltered places. On the 1st of January about 30 of them were lame and new cases developed daily for a number of weeks thereafter, also that some were yet taking the disease while others had recovered from it.

After the lapse of the first few days of sickness they regained their appetite and ate as well as ever.

The best animal in the herd of yearlings, which was also one of the first ones taken sick, died on the 5th of January; he refused to eat corn, frothed at the mouth, and suffered intense pain. The second death occurred on the 28th day of February; this was the calf, which died two days after the mother of it was taken sick. One died on the 8th of March; this one had been suffering for ten weeks, and had lost both hind feet at the fetlock joints. Three were killed. The 8 head which he bought since the disease broke out, all became sick within two or

three days after they arrived on the place. About a week after I obtained the above history Mr. Keith's hired man told me that only 4 or 5 of the 8 head bought subsequent to the outbreak of the disease became affected. I also learned from Mr. Keith that in the early part of March he received the report published by your Department for the year 1880 and 1881, which contains a brief history and description of the foot-and-mouth disease; he read it carefully, and then made his first examinations of the mouths and states he found the conditions to accord exactly with the descriptions there given.

Mr. Keith had another lot of cattle, numbering 40 head. These were two-year-old steers and heifers, and a few cows. They were kept in a timber lot, separated from the yearlings by an ordinary rail fence, and run into a stalk-field and received the same kind of wild hay as the yearlings. These cattle were bought on or about the 1st day of November. On the 28th of February the first case of sickness appeared in this herd, 15 or 20 of which manifested symptoms of the disease (March 10). Nearly all of these cattle were in excellent growing condition.

On the 13th I separated all of the well cattle from those showing any evidence of the disease on the Keith farm, and had the sound ones corraled by themselves. I recorded the temperature of a number of the yearlings which were diseased, which registered as follows: 103.8° , 103° , 103.2° , 104° , 104.8° , 105° , 104.8° . A number of the milder cases registered 100.3° , 100.2° , 101.8° , 100° , 101.5° , 101° , 100.4° , 102° , 101.5° , 100.2° , 102° , 101.6° , 101.5° , 101.2° , 101° , 101.2° , 100.8° , 100.2° , 101.2° , 102° , 102.2° . (Here I broke my thermometer). This was quite a warm day, and I noticed an increase of temperature of nearly 1° over the tests of the 9th and 10th on the same animals. I found, out of 118 animals then on the place, 74 affected; of these 2 will lose all four of their feet; 4 have lost both hind feet; 9 have each lost one hind foot; 1 four-year-old cow has lost both hind feet and one front toe: 2 lost each one toe; 3 are affected in one foot; 6 in two feet, and 1 in three feet, all of which will probably lose the parts affected. The rest were lame in various degrees.

During my two weeks' observations among these cattle I found only the one case (the yearling red steer) which I could consider in any manner a recent case.

On this day (the 13th) I also examined the pond of water from which the cattle were in the habit of drinking, but found nothing contained in it to which I could attribute the origin of the disease, and from the history which I was enabled to obtain I could not discover any origin by contamination with foreign cattle. Yet it appeared to me that this outbreak was very evidently not so contagious as the foot-and-mouth disease is known to be, and I began to have very grave doubts about its being contagious at all, or its being the genuine epizootic aphthæ.

On the 11th, in company with Mr. J. W. Beard, Judge Thatcher, and Hon. Eli K. Titus, I drove out to the farm of Mr. Beard, and made a

hurried examination of the cattle on his place, situated $2\frac{1}{4}$ miles north of Neosho Falls, in Woodson County.

I there found 5 animals, out of a herd of 75, affected similarly to those of Keith's and Goodrich's, although only one will lose both hind feet, and a second one one foot. Mr. Beard attributed the origin of the disease among his cattle to the introduction of the cow from Keith's, as before mentioned. As soon as he noticed any evidence of lameness he separated such a one from the rest of his cattle, and thereto attributes the small number affected among his herd. Two recovered from lameness after a few days. His cattle were fed on corn in the fodder and wild hay. The cattle drank from the Neosho River, which supplies good, clear water, and the approach to the drinking place is a gravelly bottom, free from mud. These cattle possess a timber shelter, with shed and hay-racks, and the feed-lot is sloping and well drained.

On the 18th I again visited Mr. Beard's place, accompanied by Prof. M. Stalker, of the Iowa State University. No new cases had appeared since my previous visit. Mr. Beard was absent, but we saw Mr. A. W. Orrill, the hired man, who made the following positive statement: That he came to Beard's place to work on the 16th of February; that on the following morning he noticed the old cow to be decidedly lame (this was the first one affected), and that on the 18th he assisted in bringing the cow from Mr. Keith's for which Mr. Beard had traded.

The Keith cow was the second one to show lameness, which was on the 22d. On the 1st of March, the third one; a day or two later, the fourth one was slobbering profusely at 4 o'clock p. m., and died the next day at 10 a. m. The fifth one became lame on the 5th, and several others manifested slight lameness, but have recovered therefrom. At this visit to Mr. Beard's we examined the feed and hay very closely, endeavoring to find some cause for the appearance of this disease. We found mixed with the hay a large proportion of the wild rye, and found this wild rye to be extensively ergotized. This discovery at once accounted for the gangrenous phase of the disease. We followed up this clue with avidity, and went directly to Keith's and to Goodrich's place, and found the same conditions present among the hay there, but not near so extensively as at Beard's. I had examined the hay at Goodrich's several times, but was unfortunate each time in seeing hay in the racks which contained but very small amounts of the ergotized grass.

On the 14th I separated the Goodrich cattle, placing the well cattle into a field by themselves. I found 18 which had lost both hind feet; 5 had each lost one hind foot; 1 had lost both hind and one fore foot, and 1 was about to lose all four feet; 40 others were lame in one or more feet. This left 31 well out of the 96 head. No new cases had appeared in this herd during the time of my stay.

On this day I left for El Dorado, Butler County, at the request of Governor Glick, to investigate a disease among cattle said to be existing at or near that place.

After my arrival I called upon Dr. A. Bassett, mayor of the city. He told me that Mr. W. B. Collinsworth, residing 14 miles west, reported to him that he had a cow which appeared very stiff and lame, and that she had sores on the tongue. I drove out early in the morning of the 15th and examined the cow belonging to Mr. Collinsworth, and found her to be recovering from a mild attack of puerperal apoplexy. I returned to Neosho Falls on the same day. On the 17th I went to Hall's Summit, Coffey County, at the request of the county commissioner of that district. I was directed to visit the residence of Mr. George R. Smith, who had a cow which had lost some of her feet. I found the cow presenting the following conditions: The left forefoot had come off at the joint within the hoof, the left hind leg had broken off half way between the fetlock and hock joint carrying the lower end of the metatarsal bone with it, and the right hind leg was coming off at the same place. The right horn had also broken off close to the head. The cow was reduced to a mere skeleton, and was suckling a calf. Mr. Smith gave the following history:

On New Year's night the cow became cast by being tangled up in the rope with which she was tied; she was found by him in the morning; was loosened, when she got up and walked away. She ate and drank as usual. About a month afterwards she began to show lameness in her hind limbs; frothed a little at the mouth, and did not eat well. She gave birth to a calf on the last day of February. This cow was bought just before the holidays, and at about the same time he bought another cow. This second cow had a calf one day later than the diseased one. Both cows and calves have been kept in the same yard and on the same kind of feed, but only the one developed the disease. They were fed on chop feed and wild hay.

I returned again to Neosho Falls on the 18th. On the 19th, in company with Professor Stalker, I visited the Keith and Goodrich herds. On the 20th, in company with Dr. D. E. Salmon, of your Department, Dr. Stalker, Dr. G. C. Faville, of Colorado, and Dr. E. T. Haggard, of Lexington, Ky., I visited again the three affected herds, and also a fourth one owned by Christian Pribbernow, on Owl Creek, 12 miles south of Neosho Falls, Woodson County. Mr. Pribbernow owns 183 head of cattle, 54 of which are yearlings, 24 two-year-old steers, 15 three-year-old steers, 13 heifers with calf, the remainder cows and calves. At this place we found 16 affected, the symptoms and lesions being similar to those of the Keith and the Goodrich cattle. Seven of them will lose one or more feet, and the other 9 manifest lameness. Two or 3 which were slightly lame have recovered.

Mr. Pribbernow stated that the disease made its first appearance on the 15th of February, when several of the older cattle were noticed to be lame; soon thereafter swelling of the hind feet and extreme lameness appeared, rendering them unwilling to walk. He then placed 7 of the worst cases into a small yard by themselves. This yard was

divided from the yard which held the yearling cattle by an ordinary rail fence. None of the yearlings became affected. The large cattle had been fed on corn-fodder and wild hay, and the yearlings in addition received millet hay and oats. The wild hay on this place contained a great amount of wild rye which was extensively ergotized.

On the 20th we saw the cattle at Beard's, Keith's, and Goodrich's, and found the conditions as herein described. After making these inspections, it was decided by Drs. Salmon, Stalker, Faville, and myself that we believed the origin of the disease among these four different herds of cattle to be due to the consumption of the ergotized grasses contained in the hay. But in order to more fully satisfy myself, I requested Dr. Salmon to accompany me to a farm lying adjoining that of Mr. Keith; therefore, on the next day, we drove out to the farm of Mrs. Dipple, which is situated west of Keith's. We there examined the hay and found it to contain a very small amount of the ergot. We also examined several of the cattle and found slight discolorations of the mouth, yet the cattle had never shown any lameness or indisposition whatever. We then looked over the well cattle on the Goodrich farm, which had been separated from the sick by me on the 14th, but found no new cases.

During the course of my investigations I killed 3 animals for the purpose of examination into the condition of the internal organs. In one I found enlargement of the heart and softening of the muscular walls; in another I found an infiltration of a purplish-colored fluid into the mesenteric glands, and in the third one I found no abnormal condition of any organ to be present. In all of these 3 I examined the alimentary canal very closely, but failed to find any pathological changes in its membranes or glands; these animals had each lost both hind feet. In carefully considering the conditions presented by all of these diseased cattle, and well weighing the value of the histories as given by the owners, I firmly believe that the disease may be called the "chronic" or "gangrenous form of ergotism."

Ziemssen says:

It is not certainly known why in the one case the ergotism assumes the spasmodic, in the other the gangrenous form. But it seems remarkable that the spasmodic form formerly prevailed chiefly in Germany, while the gangrenous form was found principally in France, and there particularly in the Sologne. But this difference does not hold universally, for epidemics of the gangrenous form have appeared also in Germany, Austria, Russia, and Sweden. It is not known whether this variety depends upon the difference in the activity of the ergot in different seasons, or whether such changes are the result of some peculiar property of the ground in which the corn grows. In the Sologne it was generally the ergot of maize which produced the poisonous symptoms, whereas in Germany the ergot of rye was almost exclusively mentioned as the cause of the disease. It is, however, very improbable that the difference between these illnesses is dependent on the different parent plants, because at least therapeutically the same effects can be produced by the ergot of maize as by that of rye, when the quantities are equal. It is most probable, then, that there is a simple quantitative difference in the absolute and relative quantity of the poison taken into the system.

Of the action upon the human system the same writer says :

The poison of this drug (ergot) has a special and most powerful action upon the skin. Besides very abundant perspiration, pustules often break out, or even larger furunculi. The exanthemata sometimes resemble scabious eczema. They appear in the later stage of the malady; as, *e. g.*, in Aschoff's case, fourteen days after the first appearance of symptoms of poisoning. But other disturbances of nutrition in the peripheral organs are also reported, as, *e. g.*, whitlows on the fingers, occurring as late as the fourth and fifth week, and diseases of the finger nails, which are encircled by a dark ring. Cardiac contractions are generally slow and feeble, the arteries are constricted and contain little blood. The respiration is very labored during the spasms, but tolerably regular in the free intervals. When death supervenes it is usually not until after a fortnight or later; the convulsions may have ceased, yet loss of sight and hearing, with violent headache, stupor, and delirium, may set in, attended with diarrhea; and thus the fatal stage may assume the form of typhus and general collapse. Death is generally ushered in by either convulsions or paralytic symptoms. The whole form of the illness, therefore, is very variable, and its course highly irregular. The illness may last four to eight weeks, and even longer.

The symptoms which characterize gangrenous ergotism as such, often appear within from two to seven days, but are frequently delayed for two and three weeks. An erysipelatous redness shows itself on some spots in the periphery, most frequently on the toes and feet, but also on the fingers and hands, more rarely on the ears and nose; soon after, the epidermis is raised like a bladder by serous exudation; the ichorous contents of this are soon discharged, and a gangrenous spot more or less large is left. Then dry gangrene develops very rapidly at the affected spot.

The part affected is very painful while the redness is invading it; but later on it becomes quite insensible. The gangrenous spot may exhibit either the dry or moist form, according to whether the discharge was checked or encouraged; upon this also depends the greater or less intensity of the odor or putrefaction. In some cases the gangrene was limited to one or more toes, sometimes only to single phalanges; in other cases, however, the entire foot or hand was affected; not infrequently the gangrene extended to the trunk; it was possible for the patient to lose both feet or both arms. Indeed, a few cases are reported in which all four extremities were lost. The gangrenous parts become separated from the healthy tissue by a well-defined line of demarkation, and the affected part may fall off itself or must be removed by an operation. This process of demarkation is often attended with serious disturbances of the general condition of the patient; sometimes a modified form of continued fever is developed followed by phthisical changes; in a few cases, from absorption of ichorous matter, pyæmia and septicæmia set in, and are, of course, fatal. When the gangrene was confined to parts of minor importance, the patients usually recovered; greater losses were naturally more frequently fatal. In some cases obstinate diarrhea brought on marasmus and death, even when the extent of the gangrene was not very considerable. We must mention, however, that in many cases the diseased process did not advance beyond the erysipelatous redness; marked cyanosis may be observed, and yet a separation may take place and the circulation be restored. The duration of the entire illness varies, and may be protracted through several months. In favorable cases the course is ended in a few weeks.

This form of gangrene, like all other forms, depends on the fact that the part affected is deprived of its blood supply, and its nutrition thereby arrested; consequently, it must pass into a state of decomposition. The only question which can be advanced here is whether it is inflammation which leads to gangrene, or whether the process is of a non-inflammatory character, resembling that which occurs when all the vessels going to a limb are ligatured. When we consider that the initial, so-called erysipelatous redness is simply dependent on the cyanosis, and that these spots are not, as in a case of inflammation, hot and swollen, but, on the contrary, they become very cold, and warmth cannot be restored in them, and that the affected limb is not at all swollen,

the hypothesis that such a gangrene is of an inflammatory character must, *à priori*, be rejected. When we further reflect that there is no fever at the outset, the second hypothesis becomes still more probable. Exclusion of an extremity from its ordinary blood supply is quite conceivable from our current views of the action of ergot on the vessels and the distribution of blood.

On the 10th of April I was requested to go 8 miles north of Sterling to the residence of Mr. John Kratz, who said that he had a number of cattle affected with lameness and sore feet. I proceeded to his place at once, and examined his herd of cattle, numbering 30 head. I found 11 cows and heifers more or less affected with excoriations in the clefts of their feet. In several cases I found these excoriations to extend around the bulb of the heels, causing a separation of the horny walls at the coronet from the fibrous structure of the foot. In one cow, twelve years old, I found considerable ulceration at the bulb of the heels of both fore feet; the matter burrowing beneath the horny wall caused a destruction of the wall to the extent of 1 inch downwards, and the imperfect formation of an inch of the horn at the front part of the feet indicated that she had been affected for two months or longer. These excoriations discharged a semi-liquid matter, which gave off an odor like to that of thrash in horses' feet. Mr. Kratz stated that two of the cows walked with difficulty for several weeks, and that for a week or more previous to their lameness he detected the peculiar odor arising from the feet while milking. On the 13th of March he bought a thoroughbred short-horn heifer, and one week after he brought her home she also became lame. When I saw her she was affected in all four of her feet, and was exceedingly lame. All of his cattle, with the exception of two that were over two years old, were affected. In none of the feet was there any swelling, but they were extremely sensitive to handling. The disease appeared as frequent in the fore as in the hind feet, and in several cases three or all four of the feet were affected alike. The majority of them became lame while the ground was yet frozen up. Mr. Kratz has one of the finest bank barns in the county, and takes excellent care of his stock. He stables his cattle at night and on stormy days; they have good bedding at night, and the stalls are cleaned daily. In pleasant weather the cattle were turned into the barn-yard. This yard is covered almost daily with clean straw to be worked into manure. The yard is sloping and well drained, and the cattle drink well water from a trough laid in the yard. During the winter the cattle received ground feed, timothy, and clover hay, but about the 1st of March he began to feed rye bran and second-crop meadow hay; the latter contained a large proportion of blue or June grass, and an examination of it revealed that it was ergotized; almost every seed capsule contained the fungus. If the ergot in the hay did not produce the disease I am unable to account for its origin. The cattle were not in a plethoric condition; the yard was free from mud, and they were well housed, and the stables kept scrupulously clean.

The disease was what would commonly be called foul in the foot. I treated them by cleaning out the clefts of their feet, applying carbolic acid solution and tar secured to place by a wad of oakum and bandage. In ten days recovery was complete.

Mr. Thomas Comboy, of Hume Township, had 2, and Mr. Edward Tyne had 1, affected similar to those of Kratz.

Respectfully submitted.

M. R. TRUMBOWER, V. S.

STERLING, ILL., *March* 27, 1884.

SYNGAMUS TRACHEALIS.

EXPLANATION OF PLATES.

PLATE I, FIG. 1.—The trachea of an adult pheasant, whose death was caused by the gapes, slit open longitudinally, and showing, in its interior and attached to the mucous membrane, about thirty pairs of syngames in various stages of development (natural size).

FIG. 2.—A pair of syngames, attached with the mouth of the male and that of the female (enlarged 4 diameters).

FIG. 3.—A pair of syngames enlarged 10 diameters; A, male; B, female; showing the intestinal canal, the œsophagus, and the buccal capsule. In the female B may be seen, in addition, the uterus and its horns filled with ova and the ovarian tube coiled around the uterus and the intestine. In the male A the testicle is seen coiled about the digestive tube.

FIG. 4. Mouth of a female syngame; A, seen from its face; B, from the side (enlarged 40 diameters).

FIG. 5.—Portion of the neck of a female (enlarged 25 diameters), showing at *a a* the cuticle finely striated; at *b* the subcutaneous, fusiform, muscular fibers; at *c* the œsophagus; at *d* a salivary gland; and at *e* the anterior extremity of the intestine into which the œsophagus opens, and which is seen lined with hepatic cells.

PLATE II, FIG. 6.—Reproductive organs of the female (enlarged 8 diameters); *a*, uterus; *b b*, uterine horns; *c c*, oviducts or Fallopian tubes; *d d*, ovaries.

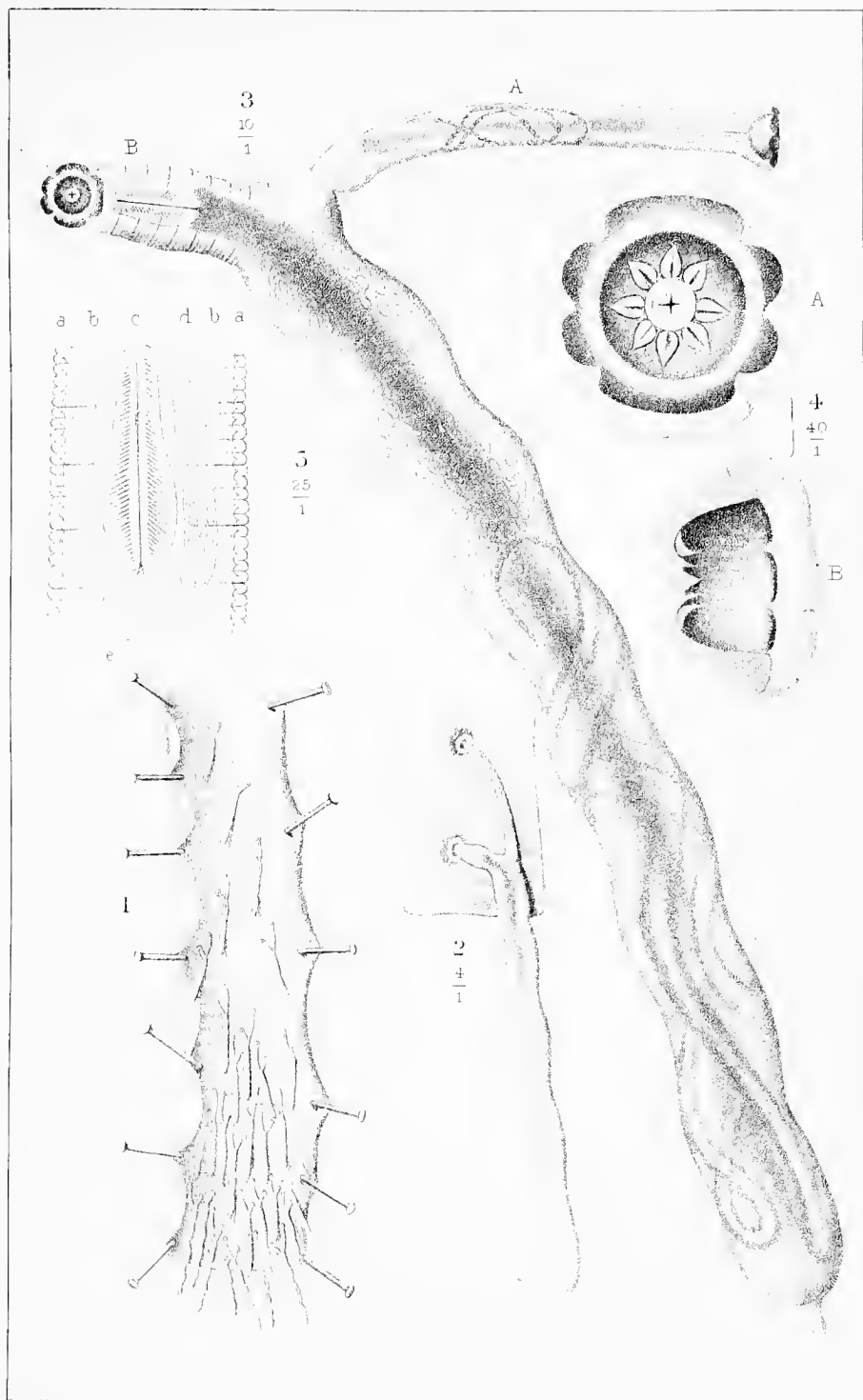
FIG. 7. Reproductive organs of male (enlarged 20 diameters); *a*, spicules; *b*, spermatic canal; *c*, vesicula seminalis; *d*, testes.

FIG. 8.—Ova in different stages of development (enlarged 260 diameters). A, vitellus, segmented and muriform; B, ovum with granular vitellus, becoming constricted at its middle, the embryo developing laterally; C, ovum with embryo fully developed, folded like the figure 8; D, ovum with the valves at the extremities detached, and the embryo emerging.

FIG. 9.—Embryo directly after leaving the egg (enlarged 260 diameters).

FIG. 10.—Embryo somewhat older, undergoing the first molt (same enlargement).

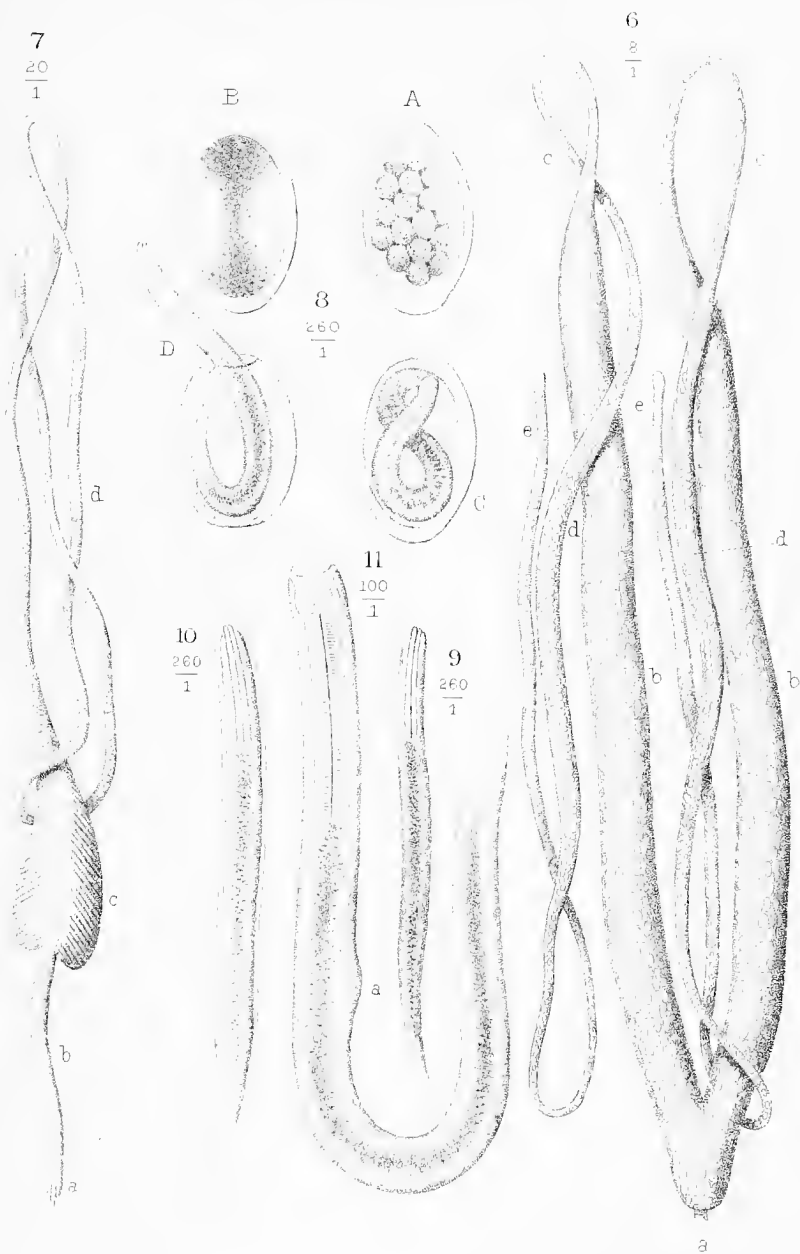
FIG. 11.—Nymph (enlarged 100 diameters); *a*, rudiment of the genital organ.



Megnin ad nat del.

A. Hoens Co. Lithographic Baltimore.

THE GAPE-WORM OF FOWLS,
Syngamus trachealis (v. Siebold) - *Sclerostoma syngamus* (Diesing.)



THE GAPE-WORM OF FOWLS,
Syngamus trachealis (v. Siebold) - *Sclerostoma syngamus* (Diesing.)

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THE GAPE DISEASE OF FOWLS, AND THE PARASITE BY WHICH IT IS CAUSED.

MEMOIR ON A VERMINOUS EPIZOOTIC DISEASE OF THE PHEASANTRIES* AND ON THE PARASITE WHICH CAUSES IT, THE SYNGAMUS TRACHEALIS (SIEB.), SOLEROSTOMA SYNGAMUS (DIES.), BY M. P. MEGNIN, LAUREATE OF THE INSTITUTE (ACADEMIE DES SCIENCES), MEMBER OF THE SOCIÉTÉ DE BIOLOGIE. HONORARY ASSOCIATE OF THE ROYAL VETERINARY COLLEGE OF LONDON, ETC.

[Translated by Dr. THEOBALD SMITH.]

For several years past the pheasantries of the hunting forests of France have been ravaged by a most destructive malady, which has killed the fowls by the hundreds and even thousands. The cause is a parasite, a so-called red worm, which develops in the trachea of birds and finally suffocates them. Particularly the young subjects, from six weeks to three months of age, are apt to be the victims, although adults by no means are always spared. The chief symptoms of this affection are a suppressed or aborted cough and a characteristic gaping, whence is derived the English name "gapes." It appears to have been observed long ago in England and America, whilst with us it has not yet been studied, a fact which seems to indicate that it has been introduced from England, and that we owe its introduction to commerce by which the hunting grounds have been restocked.

I investigated this disease on the site of its activity in the inclosures of the forest of Fontainebleau in 1878 and 1879. I received many cadavers killed by the red worm from different localities of central and northern France; from the poultry-yard of Baron Rothschild, at Rambouillet, where the daily losses amounted to 1,200; from M. de Janzé, of Gournay; from the duchess de la Rochefoucault, at Montmirail; from the inclosures at Chateau-neuf, and from various localities of Loiret and de l'Indre. Finally a dispatch, in October, 1880, informed me that the epidemic had appeared in the royal pheasantries at Turin, and was threatening to do much mischief.

This disease is not at present raging on the continent only. For ten years it has been the cause of severe losses in England. Dr. Crisp estimates that the red worm destroys annually half a million chickens, excluding pheasants and partridges, so that he says it would be of truly national importance to find the means of preventing the invasion

* This monograph, finished November, 1880, has reference to the epidemics in the pheasantries of France.

of this red worm or of destroying it.* Furthermore, the following statement is taken from the report of the meeting of the London Entomological Society, October 1, 1879 :

The president announced that Lord Walsingham, in conjunction with other gentlemen, had placed at the disposal of the council the sum of £100 to be awarded in two prizes of £50 each for the following subjects :

1. The best and most complete life history of *Sclerostoma syngamus*, supposed to produce the so-called gapes in poultry, game, and other birds.

2. The best and most complete life history of *Strongylus pergracilis* (Cob.), supposed to produce the grouse disease.

No life history would be considered satisfactory unless the different stages of development were observed and recorded ; the competition was open to naturalists of all nationalities. Essays in English, German, or French were to be sent to the secretary of the society on or before October 15, 1882.

Although birds only are concerned in this matter, it is obvious that the economic interest involved in a solution of the questions concerning the gapes is sufficiently great. The scientific interest is no less so, because there is to be determined not only the zoological position of the worm under consideration, and its rôle in the terrible disease which destroys the gallinaceans, both domestic and wild, but also its mode of reproduction, a point hitherto entirely unknown.

This is the subject of the present memoir, a memoir in which I believe I have cleared up all the pending questions upon the zoological position of the red worm, on its anatomy and physiology, on its rôle as a cause of the gapes, finally on its embryogeny and metamorphosis, and consequently upon its mode of propagation, and upon the best means of preventing its multiplication and arresting its ravages.

HISTORICAL.

The first mention of this disease was made by Dr. Wiesenthal, who observed it in 1799, at Baltimore, Md., among hens and turkeys.† In 1806, 1807, and 1809, Georges Montagu‡ saw this epizootic among chickens in England. He believed that of all the birds of the poultry yard only the hen could be its victim, because he observed that the turkeys and ducks living with the infested hens were not attacked. He observed the same malady in young pheasants at a time when they assume the livery which distinguishes the two sexes, and in partridges whether the locality was elevated or low and humid.

Both Wiesenthal and Montagu recognized that this disease was caused by worms occupying the trachea and extending occasionally to the pharynx, but never as far as the lungs. They found as many as twenty attached to the mucous membrane, which, together with the lungs, was

*Path. Society of London, October 15, 1872, and *Med. Times*, 1872, p. 474.

†*Medical and Physical Journal* (1799), II, p. 204.

‡Account of a species of fasciola which infests the trachea of poultry, with a mode of cure, *Trans. of the Wernerian Nat. Hist. Society*, I (1811), p. 195.

in an inflamed condition. These entozoa, acting finally as an obstacle to the passage of air, produced death by asphyxia.

Wiesenthal did not occupy himself with the specific determination of the worm, but Montagu regarded it as a distome, a fasciola (flake) of a particular kind, having a round cylindrical body with two sucking disks, borne on two peduncles of unequal length.

Rudolphi* and the authors of his time continued to regard the cause of the gapes in the gallinaceans as a distome, and included it in the species *Distoma lineare* (Rud).

Shortly after, helminthologists discovered, upon a variety of birds, a curious parasite likewise inhabiting the trachea, but this time belonging to the order of nematodes, and especially characterized by the singular habit of permanent union of the sexes. Siebold† made it the type of a new genus—the genus *Syngamus*; later, however, yielding to the observations of Nathusius, he renounced his first idea and united this helminth with the strongyli in naming it *Strongylus trachealis*.‡

After the creation of the genus *Sclerostoma* by Dujardin, in which this author unites the old strongyli possessing a mouth which is armed with a tough coriaceous capsule, Diesing placed in it the *Strongylus trachealis* of Nathusius under the name of *Sclerostoma syngamus*. Finally Dujardin§ restored for this parasite the old genus *Syngamus* of Siebold, and gave it the old specific name of *Syngamus trachealis* of the same author.

Dujardin ascribes to the genus *Syngamus* the following characters:

Worms ordinarily coupled in a permanent manner or by union of the integuments; the male, cylindrical, much smaller than the irregularly cylindrical female, with constricted neck and tail tapering to a point; head globular, large, supported by an internal corneous capsule; mouth large, irregularly rounded, with six or seven broadened lobes; pharynx provided with fleshy papillæ; integument folded or wrinkled without regular striae. The male has a truncated tail, the latter provided with a membranous expansion which fastens itself to the integument of the female. The female has the tail conical, elongated; vulva situated anteriorly at the base of the constriction forming the neck; eggs large, elliptical.

The following, according to the same author, are the characters of the only species *Syngamus trachealis*, which this genus includes:

Body soft, colored bright red by a liquid interposed between the viscera. Male 4 to 4.5^{mm} (.157—.177 inch) long; .4^{mm} (.016 inch) wide; enlarged, obliquely truncated head about .7^{mm} (.028 inch) broad. Tail terminated obliquely by a convex, unilateral, membranous sac or bursa .25 to .3^{mm} (.009 to .012 inch) long, attached to the superior border of the vulva of the female and supported by 12 to 15 equal rays. Female 13^{mm} (.512 inch) long; .3 to 1^{mm} (.01 to .04 inch) broad, irregularly folded and wrinkled; head 1.3^{mm} (.05 inch) broad; tail resembling an elongated cone; anus 1.2^{mm} (.047 inch) from extremity; projecting vulva at the base of a neck 1.5 to 2^{mm} (.058 to .08 inch) long, inclined to one side; eggs smooth, elliptical, .087 to .093^{mm} (.0034 to .0036 inch) long, with a short terminal neck.

**Synops.* pp. 414, 415.

† *Archiv f. Naturgeschichte*, Wiegmann (1835), p. 1.

‡ *L. c.*, 1836.

§ *Histoire nat. des helminthes in suites à Buffon*. Roret, Paris, 1845, p. 260.

Dujardin found the *Syngamus trachealis* to the number of five pairs in the trachea of two magpies (*Corvus pica*) at Rennes. He was able to determine that even after maceration the male could not be separated from the female without rupture of the integuments.

This parasite has been found by Nathusius either in Germany or in England within the trachea of the following species: The swift (*Cypselus apus*), the starling (*Sturnus vulgaris*), the green woodpecker (*Picus viridis*), the pheasant cock (*Phasianus gallus*), and the black stork (*Ciconia nigra*), granting that it was the same species.

What relation exists between the two parasites of the bird's trachea spoken of above—the fasciola of Montagu, the cause of the gapes, and the *Syngamus* of Siebold?

Dujardin and Diesing regarded as entirely erroneous the classification among the distomes of the parasite found by Montagu in the trachea of birds affected with the gapes. This parasite was to them none other than the *Syngamus*, but as they did not enter into any details concerning the accidents which it is liable to produce, some doubts appear to have remained in the minds of French helminthologists concerning this assimilation. For we read in M. Davaine's treatise on Entozoa (2d ed. p. 37) the following statement concerning the parasites which cause the gapes among the Gallinae:

These entozoa, which for a long time have been referred to the distomes, are probably identical with the *Sclerostoma syngamus*, a nematode worm, to which the permanent union of male and female has given a particular physiognomy which has deceived the earlier observers.

The word "probably," in the above extract well indicates that for M. Davaine there was as yet no certainty that the gapes was caused by the *Syngamus trachealis*; there was only a probability. Moreover, in the latest, fullest, and most noteworthy article which has appeared in France on the subject of helminthology as applied to domestic animals,* the author, M. Baillet, without saying a single word about the terrible disease, the gapes, with which in fact he does not seem to be acquainted, limits himself to noting the existence of *Syngamus* by the following sentence:

Before concluding the tribe of sclerostomes, we will mention the genus *Syngamus* (Siebold), a parasite of various birds which has been occasionally observed in the trachea of the cock and the hen.

This is all he says of this parasite. Up to the present, then, there have been only vague conceptions or none at all, concerning the pathogenic action of *syngamus*.† Even its natural history is poorly known, since in a remarkable monograph on a new nematode of the genus *Hedruris*‡ Prof. E. Perrier, citing incidentally the helminths which present the

* Article *Helminthe*, Dict. Vétérin. of Bouley and Reyal, vol. III. Paris, 1866.

† According to Cobbold the *Syngamus* is the sole cause of the gapes.

‡ *Nouvelles Archives du Museum*, vol. VII., Paris, 1871.

peculiarity of a male united permanently to a female, says, concerning the parasite under discussion, page 6 :

Among the nematodes of the genus *Syngamus* the male lives attached to the female by means of a caudal sucking disk and *twines himself about her as does the male of Hedruis*.

This last statement italicized contains an error which proves that M. Perrier had not yet seen the syngames in the position which they occupy in the trachea, for the male is never coiled about the female, as we will show further on, and as we have enabled M. Perrier to demonstrate for himself.

We are now permitted to say, after having studied the gapes in the various pheasantries of central France, and the environments of Paris, where this terrible epizootic has claimed thousands of victims, that we know positively that the parasite which causes it, the so-called forked-worm, or red worm of the pheasant breeders, is none other than the *Syngamus trachealis*, and by no means a distome; we know that it corresponds entirely with the general characters traced by Dujardin and Cobbold, if we except a considerable number of anatomical and physiological details which we have to add or to rectify, and its migrations and habits which have thus far remained wholly undescribed. There was complete ignorance of its mode of development, reproduction, and its transmigrations. All these we have been able to follow experimentally or in the poultry-yards, and hence to deduce the most rational indications to combat the gapes successfully and to arrest its spread. Experience has fully confirmed our deductions.

ZOOLOGICAL AND ANATOMICAL DESCRIPTION.

We must, at first, rectify the diagnosis of the genus and species as given by the authors, because it appears to us faulty, especially in that which refers to the mouth-parts. We present the following diagnosis of the genus :

Mouth large, supported by a hollow, hemispherical, chitinous capsule, its background furnished with six or seven chitinous, cutting papillæ; border thick and turned back (*retroussé*), cut into six symmetrical lobes, united to the integument by its entire external face, and furnished by it with four equal membranous lips, which form a prolongation to the lobed border of the capsule. To this they are united by four bands, which attach the commissures of the lips to the four deeper notches between the lobes of the capsule. Female fixed by its mouth to the tracheal mucous membrane of its host; the male likewise attached by its mouth to the same mucous membrane and united immovably by its caudal bursa to the vulva of the female, around which it is soldered, as it were. The two spicules equal, contiguous, extremely fine, and very short. Ova provided with a valve at each end of the longer axis. The eel-like embryos are developed within the uterus of the female whence they

emerge only at the death of the latter. Cuticle, with very delicate striae, disappearing with age, but persisting in the cervical region.

Are there several species of *Syngamus*? Up to the present time helminthologists have agreed to admit but a single species, the *Syngamus trachealis* of Siebold; but the characters which they attribute to it differ in certain points from those of the species which we have studied as infesting the pheasants in France. Thus the latter attains twice the dimensions given by Dujardin. The head of the male, says this observer, is obliquely truncated, while in the species examined by us it is squarely terminal. The tail of the female, Dujardin continues, is an elongated cone and the anus 1.2^{mm} (.047 inch) from the extremity, while in the parasite of our pheasants the tail is either abruptly conical or rounded like a stump and pointed; in other words, it has the form of a cylindro-conical appendage, springing from the middle of the rounded posterior extremity (Plate I, Fig. 3); the anus opens at the base of this small tail, which is not more than .1 to $.2^{\text{mm}}$ (.004 to .008 inches) long.

Unless there was some error of observation, or some typographical mistake in the figures, or unless Dujardin had not seen the highest degree of development which the syngames attain, the parasite of the pheasant would constitute a distinct species, or at least a variety.

Without wishing to decide this question, which is only possible by making a direct comparison of the individuals found on different species of birds, we shall give the diagnosis of *Syngamus trachealis* after the species or variety which infests the pheasants before offering a detailed description.

Body cylindrical, becoming with age, in the female only, more or less sinuous or torulose; colored bright red by the coloring matter of the absorbed blood which tinges the nutritive fluid interposed between the organs.

Male 2^{mm} (.079 inch) long and $.2^{\text{mm}}$ (.0078 inch) broad at the beginning of union with the female, and reaching a length of 6^{mm} (.236 inch) and a breadth of $.5^{\text{mm}}$ (.02 inch) at the end of ovulation. Body always cylindrical, surpassed in its diameter by that of the head by $.2^{\text{mm}}$ to $.3^{\text{mm}}$ (.0078—.012 inch); posterior extremity slightly club-shaped, inclined, oblique, terminated by a membranous bell-shaped sac or bursa, higher anteriorly than posteriorly, where it is cleft and notched along its entire height, supported by twelve simple rays, united to the vulva.

Female about 5^{mm} (.197 inch) long and $.35^{\text{mm}}$ (.0137 inch) broad at the beginning of copulation, attaining a length of 20^{mm} to 22^{mm} (.787—.866 inch), and a breadth at the middle of the body of 1.1^{mm} (.043 inch) at the end of ovulation; body at first cylindrical with delicately striated integument, becoming later more or less sinuous, tornlose, and smooth, the striae persisting only in the cervical region. Head 1^{mm} (.039 inch), broad at the period of complete development, surpassing the diameter of the neck by $.2^{\text{mm}}$ (.0078 inch), which is itself smaller by $.3^{\text{mm}}$ (.0118

inch) than the diameter of the middle of the body. Vulva springing from the base of an inclined neck, which is 1.5^{mm} to 3^{mm} (.059—.118 inch) long. Ova innumerable, smooth, elliptical, $.085^{\text{mm}}$ to $.09^{\text{mm}}$ (.0033—.0035 inch) long, and $.05^{\text{mm}}$ (.002 inch) broad, each pole closed by a hood-like, hemispherical valve, which becomes entirely detached at the time of hatching. Embryos eel-like, developed in the body of the female, which sets them at liberty only by its death and the destruction of its body; at birth they measure $.28^{\text{mm}}$ (.011 inch).

Habitat of the adults.—Trachea of pheasants.

We shall now study in detail the various parts of the body in the following order:

1. The general envelope of the body, consisting of the cuticle and the muscular layer lining it; 2, the digestive tube with its accessory parts; 3, the nervous system; 4, the system of excretory vessels; 5, the male and female genital apparatus as it exists in the most highly developed adults.

Body envelope.—The cuticle (Plate I, Fig. 5, *a*, *a*) is very thin, about $.05^{\text{mm}}$ (.002 inch) thick, diaphanous, in appearance homogeneous, for we have been unable to distinguish several layers, as has been done with the larger nematodes. In young subjects it bears fine transverse striæ, but in old and united pairs of which the female is bearing eggs, and especially when these eggs contain well-developed embryos, the striæ of the trunk are completely effaced, but persist on the neck, where they can be best seen in the female, in which they are $.087^{\text{mm}}$ (.0034 inch) apart, each fourth or fifth being deeper than the rest. Around the mouth the cuticle expands like a collar or gamopetalous corolla, with four equal rounded divisions forming four lips. At the same time it furnishes a broad margin to the thick and scalloped border of the buccal armature. In the male the cuticle goes to form the caudal, bell-shaped bursa, which is cleft posteriorly and longer anteriorly, the latter aspect being probably the true dorsal aspect of the worm. This bursa is supported by six simple rays on each side. It caps the hemispherically projecting vulva of the female and is united to it so intimately that even after the death of the worms and their maceration in water it becomes torn before it can be separated from the vulva.

The muscular layer which lines the internal surface of the cuticle forms four longitudinal bands, as among the other nematoid worms, two dorsal and two ventral, separated from each other by four linear intervals. These muscular tracts are very delicate and permit the internal organs to be seen through them. Only the superficial layer is distinguishable. It consists of longitudinal fusiform fibers (Plate I, Fig. 5, *b*) and is lined with parenchymatous cells, which may be regarded as a deeper muscular layer.

Digestive apparatus.—In the digestive tract three regions may be distinguished—the mouth, the œsophagus, and the intestine.

The mouth (Plate I, Fig. 4, *A*, *B*) opens on the anterior extremity of

the body. It is surrounded by four equal symmetrical lips already described. At the four commissures of these lips may be seen four strong bands or nervures, which unite the membraneous labial circle to the coriaceous armature of the mouth. This armature, made up of brown chitine, has the form of a complete hemispherical capsule or cupule, the thick border of which is divided into symmetrical but unequal lobes. These consist of two large lateral lobes, each corresponding to a lip, two small anterior ones corresponding to the anterior lip and two small posterior corresponding to the posterior lip. At the opposite and symmetrical notches at the extremities of the large lateral lobes are inserted the bands or ligaments which separate or which unite the membraneous lips. The bottom or background of the buccal cavity is a true pharynx, to which is attached the superior end of the œsophagus. It is pierced by a round aperture opening into the œsophageal cavity. On the periphery of this opening are disposed six, sometimes seven, radiating papillæ, hard like the capsule itself, with dorsal cutting edges. They are real fixed lancets, performing a function similar to those of the surgical instrument known under the name of bdellometer of Scarlandière.

The œsophagus (Plate I, Fig. 5, *c*) is relatively short, extending from the pharynx to the middle of the neck; it is club-shaped and very thick. Its lumen appears to us tetraquetral rather than triquetral, as among other nematoid worms. In fact, the pharyngeal insertion of the tube is conical, *i. e.*, with four, not three, branches (Plate I, Fig. 4, *A*). The mucous membrane is surrounded by a longitudinal muscular layer, which, in turn, is enveloped by a layer of very stout radiating fibers, longer inferiorly. The whole is inclosed in a structureless membrane.

The upper extremity of the intestine into which the œsophagus opens is very wide. It is continued by a straight, wide, cylindrical tube, lined, in its entire extent, with brownish, distinctly nucleated cellules, and terminates in a short oblique rectum, having the form of an inverted cone. The anus is situated at the base of the very short tail which measures only 1. to .2^{mm} (.004—.008 inch) in length. It appears to open most commonly on the dorsal aspect, that aspect which is opposite to the inclination of the head and neck or to the vulva. This is due to the spiral twisting of the female body when the uterus is laden with eggs. The anus of the male opens near the notching of the caudal bursa posteriorly. This shows that in the male also the ventral aspect is uppermost, which in the female is indicated by the vulva. In both sexes the anus is very small; and in fact an animal food, made up of the blood of the host, ought to furnish a very small quantity of solid waste.

Nervous system.—The nervous system of *Syngamus trachealis*, like that of the larger number of the higher nematodes, consists of a flattened ganglion forming a collar about the œsophagus, and giving off four quite symmetrical cords anteriorly and four posteriorly. The former

pass to the mouth parts, the latter to the digestive and reproductive organs.

Secretory apparatus.—The most eminent helminthologists, among them Bastian, Schneider, and E. Perrier, have seen in certain nematodes secretory structures composed of utricles sometimes double, provided with a canal which opens on the skin in the middle of a papilla. These structures have been observed near the posterior extremity of the body in the male, and in the region of the neck in both sexes. We have sought them without success in the *Syngamus* of the pheasants. Once, however, we saw, quite distinctly, an oblique canal opening on the skin a little below the œsophageal nervous ring and arising from a glandular mass situated in the region, where, in Plate I, Fig. 5, we have shown the position of the longitudinal fusiform muscular fibers. Along the œsophagus and under the same muscular layers there is situated an elongated club-shaped gland, which opens at the base of the pharyngeal capsule (Plate I, Fig. 5, *d*). This is a true salivary gland; its walls are lined with ovoid, doubly-nucleated cells.

Reproductive apparatus: Genital organs of the male. (Plate II, Fig. 7).—In the nematodes generally the testes consist of a long tube uniformly cylindrical in its whole extent from .1 to .2^{mm} (.004 — .008 inch) in diameter. In the male *Syngamus* of the pheasants it presented quite characteristic differences from the known type. It is possible to see, through the translucent tissues of the body, and still better when the testicle has been forced out of the body of the worm, a large, abrupt expansion of the tube 1^{mm} (.04 inch) from its inferior termination. This bag-pipe-like enlargement gradually contracts anteriorly and continues as a cylindrical tube slightly narrower than at its commencement. At the middle of the worm's body it twines about the intestine, then redescends and terminates in a *cul-de-sac* near the posterior extremity. The disposition of this seminiferous tube may be better seen when, by a fortunate compression, or a patient dissection, it has been forced out of the body. The three portions of which it is composed may then be readily distinguished; the first as a vas deferens, the second as a vesicula seminalis, and the third (which coils about the intestine) as the testicle proper. The latter is filled with an opaque, amorphous substance, the contents of the vesicula seminalis and the vas deferens being likewise opaque but segmented into granular corpuscles of very varying forms, having each a nucleus of .01 to .03^{mm} (.0004 — .0012 inch) in diameter. These are the spermatozooids. The vas deferens, about .075^{mm} (.003 inch) in diameter, opens at the posterior extremity of the body in the center of the caudal bursa, between two very small, short, and nearly straight spicules, the extremities of which rest immovably in the vagina of the female. The vesicula seminalis, enlarged in the form of a pear, has its walls made up of muscular fibers which are all obliquely placed and inserted into a longitudinal raphé like the barbs of a feather into the shaft. The object of this arrangement undoubtedly is to cause

the expulsion of the spermatozooids and their projection into the vagina of the female, the long duration of this function requiring a special and powerful apparatus.

Female genital apparatus, (Plate II, Fig. 6).—As in almost all nematodes, the female generative organs comprise a uterus with two long branches narrowing abruptly into a tubular portion, the ovary proper. We have not been able to discover a bag-pipe-like swelling near the commencement of the ovary which E. Perrier has seen in the *Hedruris armata*, and which he calls the copulation pouch (vesicula copulatrix). Neither this pouch nor anything similar to it exists in the Syngamus.

The vulva, as has been stated, is a small opening pierced through the summit of a hemispherical papilla which is permanently covered by the caudal bursa of the male. The vagina, the canal which penetrates the papilla, is very narrow. Lodging the spicules of the male it serves as a passage for the spermatozooids which the male pours into it during his entire adult existence. It will be readily understood that it never fulfills the function of oviduct, since the inseparable union of male and female renders the discharge of ova through the vagina impossible.

The vagina is continued into a short, enlarged uterus, about .6^{mm} (.024 inch) long and broad, which divides into two long cylindrical horns, having a diameter of .3^{mm} (.012 inch) at the base and .25^{mm} (.009 inch) at the apex. They are about three times as long as the intestine, about which they coil in the most capricious windings. The uterus and its horns are filled with ova, the development of which proceeds with the age of the worm, as we shall see further on. Each horn at its apex contracts abruptly into a short cone, and is continued by a small tube about .05^{mm} (.002 inch) in diameter; which might be likened to a Fallopian tube. After a distance of 3^{mm} (.118 inch) these tubes gradually dilate into tubes of twice their diameter, filled with spherical, granular corpuscles, compressed and crowded together in one or two rows. These are the ovules, the tubes containing them, the ovaries. As long as the uterine horns, these tubes are wound in a thousand different ways about the intestine, then contract each into a tube as narrow as the Fallopian tubes (or oviducts), containing only amorphous matter, and lastly terminate in a *cul-de-sac* devoid of dilatation or enlargement.

Amongst the ova filling the uterus and its horns, we have determined the presence of spermatozooids closely resembling those contained in the vesicula seminalis and the vas deferens of the male, but we have not succeeded in seeing them elsewhere. We believe that the fecundation is effected in the uterine horns near the ovarian extremity upon the ovules brought there by the Fallopian tubes, since there is here no organ similar to the vesicula copulatrix, which E. Perrier has pointed out in the *Hedruris armata*.

EMBRYOGENY AND DEVELOPMENT.

It has already been stated that the narrow terminal extremity of the ovary is filled with a finely granular, amorphous, opaque, and homogeneous substance. On approaching the coiled portion of the ovary this granular matter is seen to unite into spherules, which are the ovules proper. They are ranged in a single row owing to the narrow tube, the internal diameter of which they almost fill up. In the wider portion of the ovary they range themselves in two or three rows. Near the oviduct (Fallopian tube) they first become slightly ovoid, with a long diameter of $.08^{\text{mm}}$ ($.003$ inch), and they possess a distinct germinal spot and vesicle. Still without shell or distinct envelope, they are led, one by one, through the oviduct into the corresponding uterine horn, where they find themselves in contact with the spermatozooids, and where they become inclosed in a shell. When this is completed, and the egg consequently perfect, it presents the form of an ellipsoid, with a long diameter of $.09^{\text{mm}}$ ($.0035$ inch) and a short one of $.05^{\text{mm}}$ ($.002$ inch). The egg is not truncated nor provided with a neck at each extremity, as is the case with many nematodes. There is, on the contrary, at each pole a thickening, hemispherical externally and almost flat within (Plate II, Fig. 8, A, B, C). This is an actual cover, detaching itself completely when the embryo emerges. Only the empty ovum, therefore, is really truncated at its two extremities.

In the uterine horns the ova undergo complete segmentation. Their vitellus divides into 2, 4, 8, 16, &c., small spheres, which assume the mulberry form (Plate II, Fig. 8, A). The development proceeds in the lateral regions of the egg (Plate II, Fig. 8, B), and at its close the embryo may be seen rolled up in the form of a circle or a figure of eight. The egg is now $.1^{\text{mm}}$ ($.004$ inch) long and $.06^{\text{mm}}$ ($.0024$ inch) broad.

But it is not to be supposed that all the developmental phases of the ovum can be followed out in every syngame. Only in case of the largest specimens can this be done by examining successively the genital organs of the female, from the extremity of the ovaries to the body of the uterus after they have been taken from the body and well spread out. It is also possible to trace the series of successive transformations which the ovule undergoes from the embryonic to the perfect state by examining a series of females from the moment of their sexual union with the male to that of their greatest development. Thus in the syngames recently conjugated, at a time when the female is scarcely 5^{mm} ($.2$ inch) long, only spheroidal ovules are found in the uterus and its appendages, which are very short, but slightly developed, and not distinct from the ovaries, their diameters being the same. When the female has reached a length of 1^{mm} ($.4$ inch), the uterus and its horns, now quite distinct, contain eggs fully formed and inclosed in a shell, but the vitellus is not yet segmented. When the body is 15^{mm} ($.59$ inch) long the vitellus is already segmented, and has even passed

beyond the morula stage, as many of the eggs, particularly in the body of the uterus, reveal the embryo in process of development. Finally, when a length of 20 to 22^{mm} (.787-.866 inch) has been reached, eggs containing fully formed embryos, rolled up and moving within their narrow prison, are observed in the two divisions of the uterus. At this period they may be forced out of the shell by pressure between two glass slides; the covers at the extremities detach themselves completely and the embryo emerges through either opening. When it leaves the egg spontaneously, an act we have frequently observed in the water, the cephalic extremity always emerges first.

The embryo, on leaving the egg, exactly resembles an agamous anguillula (Plate II, Fig. 8, D). It is about .28^{mm} (.011 inch) long, and has a diameter of .013^{mm} (.0005 inch) at the middle of the body. The obtuse anterior extremity reveals a punctiform mouth, opening in the middle of a papilla and continued into an œsophagus which occupies the cephalic third of the body (Plate II, Fig. 9), and whose cavity is distinguished as a very fine median line. This portion of the body is clear; the remaining two-thirds is filled with granulations or fine globules. The tail is conical and elongated.

The embryos never leave the egg within the living body of the mother, however complete the development of both may be. Only by the death of the female and the destruction of its body are the ova placed at liberty. The embryo will then emerge if the medium offers favorable conditions. These are moisture and a temperature of at least 20° C. (68° F.). These facts we have frequently demonstrated by experiment and in other ways. We have even found still attached to the trachea of pheasants destroyed by the gapes couples of dead syngames, with the soft, flaccid body of the female, 24^{mm} (.945 inch) long, opened in several places by the commencing process of maceration, through which a large number of eggs had already escaped. It still contained many of them, each inclosing a fully developed, very active embryo, but there was not a single empty egg or free embryo in the entire cadaver.

We have subjected the eggs to various conditions in order to determine those most favorable to the hatching of the young. 1. When in a dry medium, as in sand, their contents dry up more rapidly in proportion to the elevation of temperature. 2. In a moist state they preserve their vitality for months, even for a year, without any perceptible modification of their contents, if the temperature is kept below 15° C. (59° F.). Under these conditions the contents finally undergo fatty degeneration and are dissolved. 3. If, while in a humid state, the temperature be raised to 20° C. (68° F.) or better, to 25° C. (77° F.), the embryo within the egg moves and turns about and finally escapes by pushing away one of the coverlets.

The combined conditions of moisture and warmth are powerful enough to bring about the development of the embryo and its escape from the egg, in which at first no trace of it can be distinguished, and which con-

tains only the vitellus. In the water contained in crystallizing dishes, small enough to be placed on the stage of a microscope, we have studied day by day the formation of the embryo during the month of July of this year, when the temperature maintained an average of 25° C. (77° F.). We have determined that in presence of these conditions twenty-eight to thirty days suffice for the development of the embryo and its escape from the shell.

The embryos or larvæ live in the water, where they swim about in a serpentine manner like the anguillulæ (vinegar eels, &c.). At a temperature of 20° or 25° C. (68°–77° F.) we have been unable to keep them alive for more than eight or ten days, whilst at a lower temperature they lived for many months, almost a year. During this time they molt, the tail becoming less elongated, and assuming the form of a short cone (Plate II, Fig. 10). When the hatching has been delayed from insufficient warmth, and the embryo finally escapes from the egg, it leaves within the shell an envelope. This fact seems to prove that the molt, which takes place normally one or two days after birth, occurs in the egg itself when birth is retarded. In the experiment-glasses larvæ with short tails were often seen moving among those with long tails. The former were simply older than the latter.

The following questions now arise: Does the larva molt a second time before assuming the adult form, and what are the ways and means employed by it to reach the only place where adult and paired syngames are found—the trachea of birds?

Some species of *Sclerostomata* presents a nymphal phase, during which the young parasite is provided with an almost complete buccal armature, and lives, rolled up and encysted beneath the mucous membrane to which it attaches itself in its adult state. Repeated investigations have failed to reveal anything analogous in the syngame of the pheasants. We have every reason to believe that the nymphal stage, no doubt very short and active, is passed in the air-sacs and pulmonary bronchi, which, as is well known, intercommunicate very largely in birds, and which the larvæ may readily reach by traversing the intestinal or œsophageal tunics after escaping from the ingested eggs. We also believe that the parasites very soon after reach the trachea, to become adult, pair, and attach themselves. The following are the facts upon which this opinion is based:

1. The larvæ of *Syngamus*, according to our observations, do not develop well, nor will they leave the egg and become vigorous excepting in a moist and warm medium, approaching the conditions offered by the interior of a bird's body.

2. In a young pheasant, dead from the gapes, we found in the mucus obtained by scraping the lining membrane of the œsophagus, a large number of eggs of syngames with the shell opened and abandoned by the embryo. We have preparations to demonstrate this fact.

3. In the serous fluids which lubricate the walls of the air-sacs, more

particularly those in relation with the duodenum, we have found in the case of young pheasants attacked with the gapes very active larvæ, almost twice as large as those just emerging from the egg, seeking their way.

4. In the cellular peritracheal tissue, in the neighborhood of the crop of one of the young pheasants referred to above, we found, stretched out parallel to the trachea, a young female syngame, already colored red, 5^{mm} (.2 inch) long, with the mouth formed like that of the adult, and even sexually matured. We think that it was a syngame which, having been delayed in the migration, failed to reach the mucosa of the trachea in due time and now could no longer do so, because the adult structure of the mouth-parts presented an impediment to its march across the tissues.

5. In the inclosures of M. de Janzé, at Gournay (Eure), which were desolated last year by the gapes, and which have presented this year some cases of this disease, the following fact has often been observed and verified by M. de Janzé himself: The young pheasants affected with this malady frequently expel, in a fit of coughing, plump, fat syngames full of eggs. The other fowls near by consume with avidity the worms thus ejected, which they, no doubt, regard as earth-worms, or the red larvæ of the large tipulæ which resemble them, and of which they are very fond. Two or three weeks later these young pheasants are sure to present symptoms of the malady—the slight, aborted hissing cough, which is so characteristic, and the gaping, which has gained for this disease its English name.

6. For the purpose of verifying experimentally the accuracy of the facts related above, the authenticity of which, however, did not give rise to any doubt, we fed to a female parrot, on the 7th of August, four pairs of large syngames. We had just received from Mme. de la R—de Montmirail some young pheasants, dead from the gapes, from which we obtained an ample number of syngames; the parrot being the only subject we had for experiment at the time. On August 28 this bird began to cough and to gape. On September 10 it died, suffocated by numerous syngames which we found, at the autopsy, crowded in the trachea.

Considering the large number of eggs—several thousand—which a cadaver of the female syngame contains, and the relatively small number of parasites—about thirty or more pairs—which reach their destination, or, in other words, come to maturity, we may form an estimate of the prodigious number of larvæ which die on their way or never succeed in finding it. It is, moreover, a law of nature, especially true of parasites, that the number of eggs laid is larger in proportion as the chances of destruction during the earlier period of existence are more numerous.

The great variation in the size, and hence in the age and the degree of development, noted among the syngames attached to the trachea of

a bird shows that there are ordinarily several successive infections or ingestions of eggs at intervals more or less extensive. This fact may also be due to the circumstance that the conditions favorable to the development of the parasite have not been the same for all.

The feeding of healthy pheasants upon syngames filled with eggs, which have been ejected by pheasants suffering from the gapes, is not the only means by which this disease may be propagated. The observations which we have made concerning the vitality retained by the eggs of the parasite when in a moist medium—a medium in which the embryos are born and developed if the temperature reaches a suitable height (20° – 25° C.)—prove that the ingestion of water and liquid or pasty aliments, containing these embryos or eggs, furnishes two other means of infection perhaps more active than the first. In every case the only media necessary for the propagation of epidemics of the gapes are food and drink contaminated with the eggs or embryos, and the birds themselves when affected with the disease, as they are then the source of an abundant emission of eggs of the parasite. No other animated medium, neither adult insect nor larva (the larvæ of ants, for example, which are a constant element of food for young pheasants, and which have been suspected with some appearance of truth), nor any mollusk, in short, can be incriminated.

MEANS OF DESTROYING THE SYNGAME AND OF ARRESTING EPIDEMICS OF THE GAPES.

The disasters caused by the parasite above described in the parks devoted to the rearing of pheasants, point out the extreme importance of finding rapid and effective means of arresting the spread of this destructive worm.

A remedy, common in England, consists in mixing the grains which are to be fed to the diseased birds with urine instead of water. Montagu, who tried this remedy without having any faith in its efficacy, was surprised at the success which he achieved, and which proved to him that it was not without utility. It is probable that the ammoniacal emanations arising from the urine are poisonous to the red worm or its embryos.

Wiesenthal relates that in America a hen's feather is stripped of its barbs to near the point, introduced into the trachea and rotated like a brush to detach the worms. We strongly question the efficiency of this practice; in the first place, because we know from experience that the worms are too firmly attached to be removed by the friction of the barbs of a feather. Should they be detached, however, they would only be pushed to the root of the trachea, where, forming a ball, they would augment the obstruction in the tube and thus bring about more promptly the death of the bird. On the other hand, the diameter of the trachea of a young pheasant from five to six weeks old, being scarcely equal to that of the shaft of a hen's feather, will not permit the introduction of

the latter. Cobbold,* on the contrary, believes in the efficiency of this method, and adds that this efficiency may be increased by impregnating the feather with a germicide substance. Bartlett, who used salt for this end, or a weak infusion of tobacco, informed him that the essence of turpentine also had given excellent results. Cobbold adds with reason, that unless great care be exercised with this method the birds may be seriously injured.†

These means, at once mechanical and medicinal, have been suggested several times and varied in different ways. One of our correspondents informed us that he had cured pheasants of the red worm by removing the parasites with a small rod and pouring into the mouth of the birds a few drops of Fowler's solution. Another pretends to have removed the parasites with a piece of copper wire, which had one end curved like a handle and dipped into *oleum hypericum* (red oil). We do not doubt that they could have succeeded in thus removing red worms lodged in the pharynx, but we do not believe that they could have extracted worms by this method from the root of the trachea near the bifurcation of the bronchi, where they are most frequently lodged; for it is actually impossible to employ a rod, and above all, a metallic wire curved into a hook, as it would undoubtedly tear the trachea. The fact that young pheasants, and more frequently adults, sometimes recover spontaneously from the gapes, may have given rise to their apparent success. This happens when they are affected by only a small number of parasites, which may go through the phases of their development to their death without producing suffocation. This is the only mode of fatal termination, and it requires a certain number of parasites, from twenty to thirty couples for adult, and from five to ten for young pheasants. In these cases the disease is cured in spite of, and not because of, a certain mode of treatment.

One of the most rational methods of treatment has been pointed out by Montagu, who did not stop with the common method above mentioned, but who obtained much success with the following means combined: Removal from the infected places, complete replacement of the

*Parasites: London, 1879; p. 445.

† Cobbold's exact words concerning this method are as follows (*loc cit*):

"First. The simplest plan consists, as Dr. Wiesenthal long ago pointed out, in stripping a feather from the tube to near the narrow end of the shaft, leaving only a few uninjured webs at the tip. The bird being secured, the webbed extremity of the feather is introduced into the windpipe. It is then twisted round a few times and withdrawn, when the worms are found attached. In some instances this plan succeeds entirely.

"Secondly. The above method is rendered more effectual when the feather is previously steeped in some medicated solution which will destroy the worms. Mr. Bartlett employs salt for this purpose, or a weak infusion of tobacco; and he informs me that the simple application of turpentine externally is sufficient to kill the worms. It should be borne in mind that the bird itself may be injuriously affected by these drugs if they are carelessly employed." Note that the turpentine is to be used externally.—ED.

former aliments by new ones, in which hemp-seed and fresh grass figure prominently; finally, for drink, an infusion of rue (*ruta*) and garlic, instead of ordinary water.

The efficacy of the garlic was demonstrated to us under the following circumstances: The pheasantry in the forest of Fontainebleau was laid waste by the gapes in 1877 and 1878. This malady, which we studied on the site of its activity, was arrested and completely driven out by feeding the pheasants with a mixture consisting of hard-boiled eggs, boiled beef's heart, the crumbs of stale bread, and salad. These ingredients were chopped, pounded, and thoroughly mixed so as to make a paste. To this paste was added pounded garlic in the proportion of one clove or bulb to ten pheasants each day, the garlic being thoroughly distributed through the paste. This mixture was relished very much. Great care was bestowed upon the drinking vessels; the very pure water used was renewed twice a day. The same treatment was successful in the several inclosures belonging to the country-seats in the neighborhood of Fontainebleau and Melun. A large number of correspondents to whom we suggested it were fully satisfied in having applied it. We also learned that the pheasants occasionally refused the garlic, and one of our correspondents informed us that he had succeeded in making them take it by preparing a real garlic salad; for he had accidentally observed how the animals which had refused the garlic paste cast themselves voraciously upon a garlic salad which was not intended for them.

We can readily explain the virtue of garlic, known from time immemorial as an excellent anthelmintic, as it is volatile and is eliminated by the respiratory passages, reaching, in this way, the trachea, where the syngames are lodged. The proof that the essential and volatile principles of garlic are eliminated by the lungs is daily furnished by those persons who, like the inhabitants of the south of France, are fond of this condiment. The odor of their breath betrays them immediately.

Besides garlic, we have experimented with another substance, which, like the former, has the advantage of being a strong-smelling vermifuge and more stupefying than ether (which might also be employed), properties which enhance its parasiticide powers. We refer to assafœtida, which we have used as a powder with an equal part of yellow pulverized gentian, mixed with the paste which is fed to the pheasants, in the proportion of 50 centigrams (about $7\frac{1}{2}$ grains) per head each day. As a complement to this treatment we have added to each liter (or quart) of drinking water the following solution: Salicylic acid, 1 gram (about $15\frac{1}{2}$ grains); distilled water, 100 grams (about $3\frac{1}{2}$ fluid ounces).

The use of the salicylic acid, the toxic power of which upon the embryos of syngames we have recognized experimentally, had for its sole object the destruction of those embryos which might be present in the drinking water of the young pheasants.

This treatment we have employed in the parks of Baron Rothschild, at Rambouillet, which were ravaged by the gapes in a manner so dis-

astrous that up to 1,200 young pheasants were found dead each morning. A letter from the baron's steward, dated September 7, 1879, testifies that the treatment has fully succeeded in arresting, in a few days even, the epidemic.

We will conclude these suggestions by stating that it is always beneficial and even indispensable to disinfect the soil of the inclosures after having transferred the young pheasants to a virgin soil. One of the best means of destroying the eggs and embryos which may possibly exist on the soil of the contaminated inclosures, consists in sprinkling it with water containing in solution a sufficiently large quantity of salicylic or sulphuric acid, one gram ($15\frac{1}{2}$ grains) to a liter (about 1 quart) for example.

Great care should also be taken to isolate the sick birds on the first appearance of the symptoms of the disease, and to keep them closely confined till complete and well-confirmed recovery. The cadavers of dead birds must be buried deep, or it were even better to burn them.

SUPPLEMENT.

In the investigations which we have made concerning the development of *Syngamus trachealis*, and which are reported in the preceding memoir, written about twenty months ago, we pointed out that the eggs ejected during the coughing fits hatch in the water, and that the embryo, resembling an anguillula, may live in this medium for many months, because we have kept some alive almost a year in a low temperature. The birds are infected by drinking the water containing these embryos. But how are they developed in the body of birds, and in what way do they reach the trachea, where they are found, in the adult state, fixed to the mucons membrane like leeches, the two sexes united in a permanent manner and the females crowded with eggs?

In the preceding memoir we stated that we had every reason to believe that the nymphal phase, unknown to us, was passed in the air-sacs and bronchi, and that later on the worm reached the trachea where it became adult. We offered as a proof of this hypothesis the discovery of embryos of syngames, in every respect similar to those which we had obtained from the hatching of ova, in the air-sacs of several young pheasants killed by the gapes.

There was, therefore, only a presumption, well founded, it is true, of the existence of the nymphs in the bronchi of the pheasants. At present it is no longer a presumption but a certainty. At the autopsies, lately made, of two red partridges, killed by syngames, we met the nymphal form in the pulmonary tissue itself, rolled up in the bronchial dilatations. (Plate II, Fig. 11.) It is cylindrical, very elongated, about 1.6 to 2^{mm}. (.063 to .079 inch) long, and .04 ^{mm}. (.0016 inch) in diameter. It is, consequently, ten times as large as the embryo when it leaves the egg, and one-tenth as large as the adult worm at the period of its greatest development. The armature of the mouth is already cupulate or

cup-shaped, but still without color, border, and lobes. The muscular œsophagus is very long and cylindrical. The intestine, which extends in a straight line from the termination of the œsophagus to the anus, fills almost the entire body, and is already colored red; near the anterior third of the body may be seen a fleshy thickening, which sends a prolongation forward beyond the posterior extremity of the œsophagus, and one, longer than the first, backward toward the caudal extremity. This is the rudiment of the sexual organ.

This discovery of the nymph enables us to say that all the developmental phases of *Syngamus trachealis* are now known. The only two media which this parasite inhabits during its entire existence are the water or moist earth during its embryonal condition, and the respiratory organs of its victim during its nymphal and its adult phase. It is, therefore, developed without the aid of any other medium than the water, corresponding in this respect to the immense majority of verminous parasites.

INTERNATIONAL VETERINARY CONGRESS.

REPORT OF DR. JAMES LAW.

SIR: I have the honor to submit the following report on the International Veterinary Congress at Brussels and the European Veterinary Schools:

In accordance with the call issued by the committee of arrangement, the Fourth International Veterinary Congress met at Brussels on September 10, 1883. There were present 311 veterinarians, of whom 218 were Belgians, and 93 from other countries of Europe and America. The congress remained in session seven days, and engaged in the discussion of the following subjects:

1. THE ORGANIZATION OF VETERINARY SERVICE.
2. CONTAGIOUS PLEURO-PNEUMONIA OF CATTLE.
3. EDUCATION IN VETERINARY MEDICINE.
4. THE RIGHT OF THE VETERINARIAN TO FURNISH MEDICINES.
5. PULMONARY PHTHISIS.

1. THE ORGANIZATION OF VETERINARY SERVICE.

This subject was ably presented by Zundel, of Strassburg, the reporter of the committee appointed to introduce it.

The veterinary profession can no longer be estimated only or mainly by its knowledge of therapeutics and its success in curing disease, otherwise it would be to the pecuniary interest of the veterinarian to keep the community in ignorance of the causes of diseases, epizootic, and sporadic, while he fattened on the proceeds of an extended practice. But to-day it is the glory of the veterinary profession that it is pre-eminently a sanitary and preventive body. It can point to-day to the comparative absence from European flocks and herds of those plagues which but a century ago desolated the countries at frequent intervals; it can show pastures now salubrious, which were formerly pregnant with the seeds of death; it can offer immunity to the system from poisons whose touch was heretofore deadly; and it can show how to extinguish in animal hosts the causes of disease, which, when conveyed to man, would entail extended suffering and death.

By his knowledge of zootechny, the veterinarian contributes to the improvement of the different races of domestic animals; by his knowl-

edge of sanitary police he protects the purchaser of animals against imposition, and knowing how to exclude epizootics he protects international commerce, which the constantly increasing facilities for communication render daily more important; by his special knowledge of animal diseases he can insure that maladies intercommunicable between animals and man shall not be conveyed to the latter through meat and other animal products.

The question of the organization of the veterinary service as a sanitary branch of every government had been extensively discussed at the Third International Veterinary Congress at Zurich in 1867, and at the following national veterinary conventions: For Germany, at Frankfort-on-the-Main, in 1872; for France, at Paris, in 1878; for Italy, in Bologna, in 1878; and for Belgium, at Brussels, in 1880.

The Zurich Congress pronounced that :

1. The practice of veterinary medicine should be regulated by law.
2. The veterinary art ought to be an integral branch, but independent, of the sanitary administration.
3. Veterinary medicine should be represented by competent persons closely related to the authorities; inferior, medium, and superior.
4. No one should be allowed to practice veterinary medicine unless he has pursued the required studies in a public veterinary college, and has acquired after examination the diploma or the legal character of veterinarian.
5. All veterinarians may be called as experts by private individuals, but the judicial authorities ought only to call as competent persons veterinarians who are officially recognized.
6. In cases of sanitary police the administrative authorities ought not to have recourse, save exceptionally, to those who have not been officially recognized as competent.
7. The expression "competent person" should be understood in the sense that he is a diplomaed veterinarian.
8. All veterinarians ought to have the right to furnish the medicines required in their practice, but always under a suitable control.

The four national conventions pronounced in similar terms for a guarantee of education and competency on the part of the veterinarian, and for the organization of a sanitary veterinary service in each state, which should deal with epizootics, advise how to render districts salubrious, and how to improve the races of domestic animals, and inspect abattoirs, slaughter-houses, and rendering works. The German convention pronounced in favor of a unification of the laws of the different German states in regard to veterinary sanitary police, and veterinary jurisprudence, and for the frequent publication of statistics of contagious diseases and mortality. The French convention pronounced in favor of including in the sanitary corps all the veterinarians practising in a department, and for the election of a departmental veterinary director by their votes.

In the spirit of these antecedent conventions the following resolutions were submitted:

1. To organize in every country a veterinary sanitary service charged exclusively with all that pertains to veterinary science, and the members of which shall be counsel of every department of the Government, but which shall be more especially represented directly in relation to the central power—that veterinary medicine shall there have her chief of service.

2. The veterinary sanitary service should utilize the greatest possible number of veterinarians. To do this efficiently and economically there should be recognized two degrees or classes of veterinarians. The one of a local nature connected less with the state than with the municipal and provincial authorities and charged with the surveillance of fairs and markets of animals, the inspection of meats of the butchery and abattoirs, the control of rendering works, the inspection of breeding animals, the inspection or direction of mutual insurance companies against the mortality of animals, the revision of the census of domestic animals, &c.; the second charged with a wider range of duties, comprising the service of the state, and capable of becoming international, embracing especially the suppression and prevention of contagious maladies and epizootics, and also the control of the different other veterinary corps.

3. Between the various states which by a regular repression and preventive service against epizootics, can furnish the guarantees of a good veterinary sanitary police there should be established a treaty having for its object: 1. To apprise the other states as speedily as possible of any eruption of Rinderpest, pleuro-pneumonia contagiosa, apthous fever, sheep-pox, *maladie du coit* (dourine), glanders (or farcy), and of scab in sheep. 2. To publish periodically a sanitary bulletin upon these diseases, their extent, progress, and extinction, which documents should also be published in the international bulletin if judged necessary. 3. To oppose these diseases by measures of sanitary police which have first been discussed and adopted as the most advisable. 4. To furnish with animals and herds that are moved into and out of a territory certificates of origin and health of a guaranteed administrative value. 5. To contribute to the publication of an international veterinary sanitary bulletin.

FIRST RESOLUTION.

Among the arguments advanced in support of the first resolution were the following:

In various countries of Europe and America these duties essentially veterinary are left too much in the hands of persons ignorant of veterinary science. In some they are largely dealt with by bodies mainly medical—sanitary boards. No one denies the great debt of veterinary medicine to that of man. The works of the physician in anatomy, physiology, pathology, surgery, &c., furnish the most valuable material for the medicine of animals. The principles of both branches of medicine are the same. The observations and experiments on animals made to advance the one are of the highest value to the other. Many of the parasites and zymotic poisons of man are common to the animal as well. But when we come to the application of these principles to the diagnosis and treatment of disease in animals the physician finds that the two medicines diverge at every step, and that without a special training he is helpless to deal with that of animals. At one time physicians could be found who were more accomplished in microscopy, &c.,

than the veterinarian, but to-day in the veterinary schools of Europe the subjects receive as ample attention as in the medical.

In some cases the bureaucratic element tends to the subversion of the veterinary, and men whose only knowledge of veterinary matters come from consulting the writings of some one veterinarian will pass judgment upon the advice of the most skilled expert, and even decline to employ it. It is for the jurist to formulate and promulgate the laws, but it is his duty to base these on the best counsels of veterinary medicine.

To maintain a satisfactory system not only must the veterinary sanitary work in departments and cities be carried on by veterinarians, but there must be at the seat of power a veterinarian or commissioner of veterinarians as a centralizing point for all that relates to the veterinary service, and for the direction of that service. As countries in which such centralization exclusively veterinary has been secured may be named Holland, Denmark, Sweden, Russia, some of the southern German states, Saxony, Bavaria, Baden, and Alsace-Lorraine, Portugal, and Belgium. In Austria there is a consulting committee on epizootics, but which occupies itself with prevailing maladies alone. In the dependent Austrian states the Landesthierarzt is a simple member, sometimes a simple agent of the sanitary council. In Prussia there is not even a chief veterinarian in relation to the minister, who only consults the technical deputation in which veterinary science is represented. In each provincial government of Prussia a departmental veterinarian or assessor is attached usually to the medical council as councilor (referee) for veterinary service. In France the veterinary element now predominates in the superior committee of epizootics. In England the privy council veterinary department has three veterinarians in a body of six members. In Switzerland, attached to the department of agriculture, is a veterinary commissioner of epizootics as counsel on the whole subject of federal veterinary police, but he has no voice as to the competence of cantonal authorities. In Italy there is no central veterinary officer, and the bulletin of epizootic statistics is compiled from data furnished by municipalities.

After considerable discussion the following was passed with only four dissenting votes:

To organize in each country a veterinary sanitary service, charged exclusively with all that pertains to this service, of which the members, all veterinarians, shall be councilors of all branches of the administration, but which shall be especially represented near the central authorities, where the chief veterinary official shall be stationed.

SECOND RESOLUTION.

In regard to this the reporter pointed out the impropriety of binding the Government to employ as its local expert the veterinarian who happens to be in attendance upon the infected herd, the danger of such a person carrying infection to other herds in the round of his practice, the suspicion, usually unmerited, that he may hide infection in the inter-

ests of his employers rather than apply rigid measures of extinction for the good of the commonwealth, the fact that he may be an excellent general practitioner and yet not a specialist in epizootics, who may counsel treatment when the best sanitary science imperatively demands sacrifice, who will make a dangerous distinction between farcy and glanders, or who will prefer preventive inoculation in pleuro-pneumonia to slaughter. What can be expected of the veterinarian who has become hopeless and apathetic, whose calling is to him but a handicraft, or who has become morally debased?

The increasing numbers of live stock, the facility in transporting them long distances by steam, and the great demands of Western Europe for outside supplies demand for the inspector of to-day a very different official from those of the past. The lack of a thoroughly efficient veterinary sanitary service was felt when the lung plague attained such a wide extension in 1840, when the Rinderpest ravaged Holland and England in 1865, and France in 1870, when influenza spread over America in 1872, lung plague in 1878, or when hog-cholera destroyed in a single state hogs to the value of \$20,000,000 in one year.

Already a good beginning has been made in different states. Holland has nine district veterinarians under state salary. France has in the department of the Seine five exclusively occupied in the state service; England has twenty-three salaried port inspectors; Portugal has twenty-one on state salaries, not large enough, however, to make them independent of practice, and the same applies to the states of Germany and Austria where the Government veterinary officers have regular salaries, but insufficient for their entire maintenance.

The field with which a departmental veterinarian is charged should be large enough to insure that the office shall be no sinecure, and that he shall not by private practice interfere with that of the local veterinarians. He should be appointed after a special examination, or exceptionally for signal services in sanitary police.

The department veterinarian should counsel the central authorities, advise legislation, take the direction in the prevention and extinction of epizootics, and direct the work of the local veterinarians. To these last would be left the inspection of fairs and markets, meat markets, slaughter-houses, &c., of animals sent by railroad, and the general local work of the service. They should make to the chief veterinarian written reports of any extraordinary occurrence in their district and periodic reports of the general work accomplished. These will furnish data for the publication of statistics of the animals kept, bred, purchased, sold, killed for food, dying of sporadic and epizootic disease, attacked by epizootics, &c. These in relation to geology, soil, drainage, meteorology, culture, breeds, breeding, alimentation, use, &c., will supply data of the greatest value to stock holders, veterinarians, hygienists, physicians, dealers, and political economists.

As a rule the destruction of animals to arrest an epizootic should be

ordered by the chief or departmental veterinarian, thereby securing at once the guarantee of a diagnosis by more than one expert and saving the local veterinarian from the unpleasant duty of ordering a work that may be unacceptable to his regular employer.

Not the least important duty of the local veterinarian is in connection with the mutual assurance of animals against deaths from sporadic diseases. Losses from epizootics are indemnified by the state, but losses from diseases that are not communicable justly become a tax on the stock owners of the municipality or district. Such an arrangement engages the interest of the stock owners not only to report the contagious diseases early, but the non-contagious as well, and to use all resources of science for the cure of the latter, but much more for their prevention. The local veterinarian as a regular officer of such societies, directing, supervising, inspecting, finds his interest consulted in urging all that can conduce to health in breeding, management, and treatment, and wherever such associations have been introduced there has been a notable improvement in all that pertains to the quality and numbers of the live stock.

The local veterinarian, being an essential part of the national veterinary sanitary service, it should not be in the power of the local authority to discontinue his services, nor to appoint to the position any one but a competent veterinarian (a graduate).

After discussion mainly of the right of the sanitary veterinarian to engage in ordinary practice, and of the desirability of specifying two classes of veterinary officials, the following was adopted by a large majority :

2. That the veterinary sanitary service should utilize the greatest possible number of veterinarians. It embraces the inspection of fairs and markets of animals, of meats of the butchery and abattoir, the control of rendering works, the inspection of breeding animals, the supervision or direction of mutual assurance societies against the mortality of beasts, the revision of the census of domestic animals; * * * it comprehends the service of the state and may become international, embracing especially the repression and prevention of contagious maladies and epizootics, also the control of all other veterinary service.

THIRD RESOLUTION.

In support of the third resolution Zundel advanced that contagious maladies are no longer recognized as of spontaneous origin; that day by day the advocates of spontaneity yield the point, and that well-observed facts prove that it is by contagion that these maladies are at once propagated and perpetuated. To prevent the propagation of these maladies it is necessary to have in all countries enjoying an international commerce in live stock a common, permanent, and efficient system of preventing or at least of arresting them in their inception. The value of an international arrangement for the control of Rinderpest has long been recognized and becomes yearly more important. The demands of Western Europe for a meat supply are constantly increasing, while

the animal production in Western Europe remains stationary, or even diminishes. This imperious demand for beef, and the facility for its supply by cheap railway transport from the East, cannot fail to insure an increase of the Eastern traffic, and unless conducted under efficient international measures of protection this must deluge the West continually with this most fatal of all bovine plagues. The improved culture on the Steppes and the introduction of better forage plants enable the stock owners to tide over the dry summer and the frozen winter more satisfactorily, and thus contribute still more to the numbers and excellence of the Eastern supply. Austria imported 20,000 Russian cattle in 1861, 30,000 in 1868, and 55,000 in 1872. The more stringent restrictions have later lessened the numbers, but the increasing demands of the West and supplies of the East must, ere long, turn the tide once more, and bring large installments of these Eastern beeves. Hitherto protection has been sought by the more or less perfect exclusion of Steppe cattle, but the time must come when this shall be superseded by an international arrangement founded on solid guarantees of the soundness of the cattle exported.

Already in regard to Rinderpest this has been attempted; to-day all the different countries of Germany act on the same law, that of 7th April, 1869, in repelling and repressing this plague, and in April, 1872, Austria called in Vienna a conference to consult as to the requisite international guarantees, and delegates attended from Germany, England, Anstro-Hungary, Belgium, France, Italy, Roumania, Russia, Servia, Switzerland, and Turkey. If each country would organize an efficient service to stamp out Rinderpest as far as possible and to prevent its radiating outward from any existing center of infection, every state might by this perfect isolation of its limited infected area secure an untrameled cattle traffic for its entire territory besides.

The same can be done for contagious pleuro-pneumonia, and it is easily demonstrated how much evil has already resulted from the neglect of other Governments to respond to the Swiss movement in this direction in 1876. From this England loses yearly about 5,000 cattle Belgium, 2,000 to 3,000; Prussia, 2,000; Wurtemberg, 500; Austria, 2,000 to 3,000, and France and Italy corresponding numbers. Rinderpest is comparatively easily suppressed, because its prompt eruption and fatal issue strikes the population with terror and it cannot be hidden; but the lung plague strikes slyly, hides its tracks, and, creeping into the stables unseen, it diffuses its poison, infects, benumbs, and paralyzes the lungs without the body appearing to suffer, and it only manifests itself by outward symptoms when all is lost. More than this, the lung plague often assumes the benign and almost latent form, so that after months of incubation it still rests unrecognized and unsuspected, assuming a chronic type, but still scattering the poison, and the subject even appearing to recover, without an abatement of its infecting power. Often, too, the laws, and even very recent ones, take but half

measures against this plague, leaving it to intrench itself more and more firmly and to maintain itself permanently in a country where it is only an exotic, a foreign invader, and where it could easily be excluded through an efficient international system. For this, therefore, even more than for rinderpest, an efficient system of mutual international protection is urgently demanded.

The apthous fever is largely combated by restrictions on the movement of cattle and the interdiction of fairs and markets, yet these rarely arrest its progress, but the barriers that put a stop to the rinderpest allow the apthous fever to pass, as happened in Saxony in 1867. With such a diffusible poison success must be sought in its declaration, suppression, and seclusion in the home herds and by preventing it from passing at all into the channels of traffic, and this can only be secured through a common international system.

Formerly lung plague, apthous fever, and sheep-pox remained habitually circumscribed in particular districts; to-day, with the great movements of stock in mass, their concentration in vast markets, and their constant changes in the large feeding stables, it has become impossible to deal effectively with these plagues except in native herds, and this imperatively demands a uniform international system, with solid mutual guarantees.

Glanders and farcy occurring in an occult form with lesions internal and unsuspected, and following a chronic course, is another fruitful source of trouble, and a country that pays for such animals when slaughtered especially suffers, as the diseased animals are smuggled across the frontier in order to secure the indemnity. Even the residence of several months required in order to the payment of indemnity is insufficient to guard against this sharp practice.

The mad dog does not always take the road to the custom-house, nor recognize the colors of the frontier posts. Here, therefore, it becomes necessary to maintain a common system of repression and the mutual notification of the existence of rabies.

Maladie du coit, though unlike the two last, in that it respects the human family, should yet as regards the equine races be made the object of international guarantees.

Anthrax and several parasitic maladies, including even measles and trichinosis in swine, are more purely matters of local danger, and are to be controlled by local measures and by inspection in the great meat markets.

Energetic sanitary measures within the limits of a single state have been often notably successful, as against lung plague in Switzerland, Holland, Portugal, Sweden, and Denmark against sheep-pox, apart from Northern Germany and Hungary, and against rabies in Baden. How much better if there were a common international co-operation, which would at once more effectively repress animal plagues and release the commerce in live stock and all their fresh products (hides, hoofs, hair,

bristles, fat, guts), as well as fodder and straw, from the present obnoxious and injurious restrictions.

Unfortunately in all modern legislation on the subject not only are the laws peculiar to the individual state, but they reflect the jealousies and lack of adjacent states. Thus in the absence of official trustworthy and trusted reports a whole country has its trade restricted, delayed, and seriously injured for a slight outbreak which could easily be sequestered and a perfect guarantee of its non-extension furnished. It is to be feared, indeed, that in some instances what is practiced under the name of veterinary sanitary police is conceived more in the spirit of maintaining the high price of meat than of restricting and extirpating animal plagues.

If the work could be made international, and if the plagues could be effectively dealt with in the local areas of their prevalence, all the more obnoxious interference with commerce might be done away with, the present temptation to clandestine trade in infected animals obviated, and a better and more reliable protection afforded.

The inspection of animals at the frontiers has proved practically useless, because animals that have become infected but do not yet show signs of disease are necessarily allowed to pass, and with the modern immense railway traffic in fat animals a sufficient quarantine is practically prohibitory of importation.

Another grave objection to this system is that animals found diseased are simply sent back over the frontier, and as the service is national and not international, the neighboring state is not warned of the active focus of infection thus created within it.

Certificates of origin and health emanating from officials and based on expert knowledge of the sanitary condition of the district furnishing the stock should be really valuable documents, whereas certificates made out by irresponsible individuals, and with which the smugglers are now most numerous supplied, are grounds for suspicion rather than confidence.

The following sum up the principles which ought to dominate in an international veterinary sanitary service:

a. Each state ought to notify the governments of adjacent states of those joining the international agreement, and of all that desire it, of every outbreak of rinderpest, lung plague, sheep-pox, *maladie du coit*, glanders, and rabies, its exact locality and extension; and this should be done as quickly as possible, even by telegraph.

Other grave maladies transmissible and importable, and especially the typhoid affections and sheep scab, should be made the object of extraordinary precautions and mutual notification.

The authorities ought to carefully investigate the channel by which contagion finds its entrance and is propagated; and the officials of the country from which it was derived should be furnished with the information necessary to enable them to trace it to its earlier sources.

Each Government ought to publish in its official organs a sanitary bulletin upon the sanitary states, the progress of epizootics, the measures enforced, the interdictions of imports, the changes made in these prohibitions, and of the suppression of the plague when that has been effected. This bulletin should be sent to editors of official journals of states that request it or that have signed the agreement.

b. The authorities of frontier districts ought to notify directly the authorities of neighboring districts whenever rinderpest or aphthous fever has been detected within 100 kilometers (62 miles) of the frontier, or when lung plague, sheep-pox, glanders, or rabies has appeared within 50 kilometers (31 miles) of the frontier. In rinderpest, sheep-pox, and rabies the notification should be made by telegraph.

c. Every state should so organize its veterinary service as to be able to rapidly stamp out rinderpest or other contagious maladies.

d. Every state should provide that the laws of sanitary police should be rigorously enforced.

e. By previous arrangement the laws of sanitary police in different states should be almost identical in measures of isolation, veterinary surveillance, sequestration, removal and burial of carcasses, and in disinfection of all persons and animals, of objects, clothing, and harness, stables, and of railway cars that have carried animals or animal products.

f. For all animals attacked or suspected of one of the contagious maladies above mentioned, and killed by police order, an indemnity should be paid, which each government may fix by special law, but which should in no case be less than half the value of the animal if it had been sound.

g. A previous arrangement should prescribe the principles which ought to control the international relations, the roads and means of transport to be taken, the conditions of movement of stock, and, above all, that which refers to certificates of health and origin, which ought as much as possible to be uniform in the different countries, and for the important assignments visé by the consuls of the respective countries.

h. The laws of sanitary police should order the transporting agent to make instant declaration of diseases that may supervene in transit, and should prescribe the measures of sanitary police applicable to them.

i. There should be published an international sanitary bulletin at intervals of fifteen days, and giving the sanitary condition of each country according to the special bulletin, which by international agreement each government should publish. The international guarantee should be based on government morality, on a spirit of justice, on practical reason; thus commerce will acquire that freedom and integrity which are essential to it. It should prescribe the movement of all stock coming from a country, the sanitary condition of which is unknown. The great publicity given to the official reports, often sent by telegraph and diffused through the most rapid channels, would give a guarantee of their

veracity; they ought to emanate from the authorities of the countries and be drawn up by veterinarians.

With this bulletin they would know at each custom-house what countries can supply stock to international markets, and from what the stock must be refused; this international bulletin should be a check on certificates of health and of origin, and should enable the officials to appreciate their value.

The bulletin would thus furnish the best mutual guarantee for international commerce, and give mutual confidence between nations carrying on with each other a traffic in domestic animals.

The nations will better comprehend on the basis of epizootics what they generally fail to arrive at on that of politics. One step may perhaps lead to others.

The third resolution, adopted unanimously, reads as follows:

Between the different states, which by a regular service repressive and preventive of epizootics are able to furnish guarantees of a good veterinary sanitary police, there should be established an agreement having for its object: 1. To notify other states, with the least possible delay, of the eruption of lung plague, apthous fever, sheep-pox, *maladie du coit*, glanders (or farcy), and sheep-scab. 2. To publish a periodic veterinary bulletin on these maladies—on their status, extension, and terminations; which information should also be sent to the international bulletin, if judged necessary. 3. To combat these maladies by measures of sanitary police which have been previously discussed and adopted as the best. 4. Not to permit the delivery of animals nor of herds which are being sent in or out of the territory, except on certificate of origin and of health of a guaranteed administrative value. 5. To contribute to the publication of an international veterinary bulletin.

REMARKS.

The above has been reported at considerable length because of its manifest bearing on the problems which now press on the American people for solution. In America, as in Europe, the medical and political authorities have undertaken too much of what properly pertains to the veterinary profession, and, as a consequence, we have had measures that aimed at repression rather than extinction of animal plagues, and the administration of these and even of better measures has been made in such an irregular and badly sustained manner that what had been gained to-day by much effort and outlay was lost on the morrow by a relaxation or entire suspension of the rules.

To have efficient legislation the best available veterinary advice should be secured as to the measures to be framed in a bill, and a veterinary authority should be intrusted to see the statute rigidly and impartially administered. Place it in the hands of a mere beaurocracy and this will too often, as in the past, result in its administration in what they consider the spirit—not the letter—of the law, until all its valuable provisions are frittered away and lost. A knowledge of the diseases is essential to a knowledge of the fundamental principles on which suppressive measures must be based, and, in ignorance of these

principles, any attempt to carry out the law in its spirit rather than its letter is sure to end in blundering and failure.

Then, again, as regards interstate administration, nothing can be more instructive to Americans than the European difficulties in dealing with the animal plagues under the modern conditions of great manufacturing prosperity and the unprecedented activity of the traffic by rail. Examinations of cattle in transit must be given up as absolutely inefficient, for herds that formerly developed disease during the tardy and toilsome movement by highways can now be sent through in a few days by rail and long before the deadly germs within them can manifest their presence by overt symptoms. No better commentary can be furnished on the utterly futile provisions in a number of successive Congressional bills for the inspection of cattle in transit in our inland trade and of beeves about to be shipped to Europe. Again, the enormous proportions of the constantly increasing cattle trade toward mining, manufacturing, and commercial centers in Western Europe has been found to be utterly incompatible with the maintenance of such a quarantine as would protect against imported contagion, and they are for the first time brought face to face with the fact that the protection of any country in the line of this great cattle traffic must be secured, if at all, by a perfect system of seclusion and suppression in the country which furnishes the supplies of live stock, and by an honorable exclusion by such country from the channels of traffic of all live stock and their fresh products having their origin in an infected district. American lawmakers and administrators must see that our uninfected States and Territories can have no guarantee of continued safety in our present system under which live stock from infected States and districts, without even the pitiful and comparatively useless form of inspection and certificate, are sent to the very source of our great live-stock traffic. Fortunately for us our westward traffic in live stock is so limited that it is quite possible to impose an effective quarantine on all subjects moved in that direction. If nothing more can be done, this at least is within our power. Each State can quarantine all cattle or other live stock from an infected State, or if the State fails in its duty to itself and neighbors the United States can step in and regulate this item of interstate commerce.

Again, the experience of Europe with her great live-stock traffic by rail shows how utterly helpless we would be in any attempt to control these animal plagues if they once reached the source of this traffic. As is now the case with Texas fever, our first resort would be to prohibit all movement of susceptible stock from the infected areas, and the next to seek by every possible means to stamp out the infection on the native herds. If Europe with her extensive, not to say universal, fields of infection, finds her profit in maintaining a uniform veterinary sanitary service, operating at every point over the broad continent, and suppressing and secluding animal plagues wherever they may appear, how much

more profitable must it be for the United States in dealing with her one exotic and imported plague, that of the lungs of cattle, which is still confined to the merest strip of her territory, and when the proposed control is to prevent its extension over the whole continent, and the necessity for a similar service and control from the Atlantic to the Pacific? It would require but the outlay of a sum equal to half our yearly losses on cattle exports by this cause alone to abolish this cause forever; it would require but the expenditure of a trifling fraction to save us from the future loss of millions. Again, if the independent nations of Europe find it necessary to have an international system of repression and extinction to expel their prevailing animal plagues, and if they have to sink national jealousies and rivalries in the presence of these international enemies, will the United States of America, with a Federal Congress and one Federal Executive, sacrifice to a sentiment our birthright to the most extended live-stock interests in the world?

Shall we calmly see the European states, with a legacy of ages of warfare and mutual hate, and ground down by their immense standing armies, the root and fruition of their common suspicions, unite cordially and loyally in a common international work to crush out the prevailing infections of centuries and to secure an untrammelled traffic in healthy live stock and sound meat while our mutually dependent States, bound in one federation, an unit in war, an unit in commerce, and an unit in all that relates to foreign nations—shall these States let a mutual jealousy prevent an interstate sanitary work court the general diffusion of our exotic infections, load the continent with animal plagues under which modern conditions must be more ruinous even than those of Europe in the past, and shut themselves out from supplying the meat market of the world which it is now theirs to take and to hold?

2. CONTAGIOUS PLEURO-PNEUMONIA OF CATTLE.

This subject was introduced by an extended report by Professor Degive and two supplementary reports by Messrs. Leblanc and Putz. Degive arrived at the following conclusions:

A.—DIFFERENTIAL DIAGNOSIS.

1. From an anatomical point of view we may consider as contagious and epizootic all interstitial pneumonias of a certain extent of which the development does not depend on local conditions or causes.

2. From a physiological stand-point, epizootic pleuro-pneumonia is especially characterized in the living animal by its contagious character and the symptoms of lobar pneumonia.

3. In an infected stable every animal that shows fever with one or more symptoms denoting irritation of the respiratory organs, cough, hurried, plaintive breathing, &c., should be suspected of pleuro-pneumonia.

4. The spontaneity of one case of pleuro-pneumonia will not exclude the existence of the contagious affection.

B.—PROPHYLAXIS.

1. The development of pleuro-pneumonia may sometimes be prevented by a simple recourse to good hygienic conditions.

2. Animals affected with the malady, or suspected of it, should be sacrificed as quickly as possible.

3. Animals suspected of infection, or very much exposed to contagion, should be isolated or sacrificed. The slaughter of animals suspected of infection is more especially indicated when the disease manifests itself very exceptionally, or for the first time, in a stable belonging to a commune rich in cattle.

4. Animals suspected of infection, or very much exposed to contagion, and not sacrificed, would be profitably submitted to inoculation or to an appropriate preventive medication. Inoculation is especially applicable when the animals make part of a large herd, subject to frequent changes, or where the malady has already appeared several times.

5. Inoculation should not be prescribed as a general or obligatory measure until a method is devised which can be practiced without danger to the health or life of the beasts operated on.

6. Inoculation should not be practiced without the previous authorization of the local authority. It should only be done by a veterinarian and under police surveillance.

7. Every inoculated animal should be considered as suspected of contamination and treated as such.

8. The diseased and suspected animals should be reported to the authority with the least possible delay. This report should be made obligatory on owners and attendants, veterinarians, and inspectors—the experts of the abattoir or butchery.

9. Quarantined (isoles) animals should be made the object of a special census and should receive a distinctive brand with a hot iron.

10. No animal suspected of infection should be moved without previous authorization of the communal administration. The permit to move should only be granted for animals destined to the butchery; it should only take place in special conditions, under the supervision of the police and in such a manner as to prevent all propagation of the malady.

11. Every bovine animal offered for sale ought to be accompanied by a certificate of health testifying that no epizootic has existed for at least six weeks in the commune from which it came.

12. In certain special cases to be determined by the veterinary official there may be prescribed the suspension of fairs and markets, the prohibition of the importation of animals from a suspected country, quarantine, the posting of notices at the entrance of infected circles or farms, and the writing of handbills and instructions warning the population of their obligations and of the precautions to be taken to prevent the appearance or extension of the malady.

13. An active supervision should be exercised, not only over the quarantined beasts, but also : *a.* Of animals exposed for sale in markets, fields, and fairs. *b.* Over animals lodged temporarily in the stables of inns adjoining the markets. *c.* In stables containing many animals subject to frequent changes, and when the malady has already made one or several outbreaks.

14. The duration of quarantine should be for 45 days at least after the disappearance of the disease.

15. At the release from quarantine the cattle should receive a second mark to annul the effect of the first.

16. The flesh of an animal slaughtered should not be used for food unless authorized by the veterinarian making the autopsy.

17. The skin should not be utilized until it has been steeped for at least twenty-four hours in an approved disinfectant solution.

18. Carcasses and cadavric debris unfit for food should be buried or so treated as to become absolutely inoffensive.

19. Stables, fair-grounds, markets, and vehicles which have been occupied by diseased or suspected animals, should be carefully cleansed, disinfected, and purified. These different operations should be under the direction of a veterinarian.

20. A stable perfectly disinfected and purified by eight days' free ventilation may be refilled without danger.

21. Pasturages that have been occupied by diseased cattle should be shut up for forty days at least.

22. The different materials, objects, and instruments that have been employed in the slaughter, transportation, and burial of diseased or suspected animals should be destroyed or thoroughly disinfected. Forage and litter should be utilized for horses and other solipedes.

23. Persons who have become soiled by infecting materials should wash their hands, brush or wash their clothes, and wash their boots with a disinfectant solution.

24. All persons and animals capable of carrying the virus should be, as far as possible, kept from diseased animals, their carcasses, and cadavric debris.

25. Indemnity should be accorded: 1. For animals slaughtered officially. 2. For those that have died from inoculation. 3. For different objects or instruments of which the destruction is judged necessary.

26. Very heavy penalties should be imposed on persons who violate the different sanitary regulations ordered by the authorities.

27. A good organization of the veterinary service is the best guarantee of the application of the different measures prescribed.

28. A last and potent measure for securing the extinction of contagious pleuro-pneumonia consists in adopting a provision for the contagious diseases of animals as has been done for the phyloxera of the vine; to formulate an international agreement, in which shall be indicated the essential elements which ought to form the basis of the legislation to be adopted by each country which shall join it.

Dégive justly accorded to lung plague a principal place among the plagues which are most detrimental to agriculture and the public wealth. In enumerating its anatomical lesions he lays stress on the inflammatory action being especially provocative of exudation into the interstitial connective tissues of the lung—interlobular, perivascular, interalveolar, and subpleural—upon the prominent implication of the lymphatics, upon the great extent of lungs involved even when the general symptoms of illness have only just appeared, upon the presence of lesions of different ages, implying a long standing and a slow and occult progress of the disease, and the existence in the exudate of the specific micrococcus of Willems, Brylant, and Verriest. (Strangely enough, he fails to emphasize the infarctions and encysted sequestra which are so characteristic of the affection.) Under the head of physiological characters, beside the general symptoms of fever and inflammation of the lungs, he lays special stress on the two types of the disease, rapid and slow, the latter remaining insidious, hidden, and apart from indications furnished by auscultation and percussion, hardly recognizable throughout its entire course; on the mortality averaging 30 per cent.; on the infectious property, very variable in different cases, but always highly conclusive when well marked. He seeks to establish a theory of spontaneity from the facts that in many cases contagion cannot be traced, that Grawitz, Greenfield, and Buchner have cultivated pathogenic fungi and bacteria

until they have become harmless, and harmless germs, until they have become pathogenic.

Under prophylaxis Degive adduces instances in which a thorough attention to the laws of hygiene in ventilation, lighting, feeding, &c., have seemed to arrest the propagation of the poison. In this as in the question of spontaneity the experience of Degive, limited to a country in which the disease constantly prevails, is misleading. He fails to take into account such sweeping evidence as the entire absence of the lung plague from America, South Africa, and Australasia until the occurrence of a single importation of disease, and its deadly prevalence in all three from that moment onward, notwithstanding that in the two last-named places the victims enjoyed an open-air life in mild and equable climate, the most favorable possible for the lungs. He further ignores for the instant the irregular and occult cases of the disease which confer immunity, and at once explains the sudden disappearance of the disease in particular herds coincidently with a better hygiene or a worse one, and the introduction of infection into a new locality where the best efforts of the veterinarians have failed to trace its source.

Degive strongly advocates inoculation, supporting his view by the following facts :

1. Out of 6,706 inoculated cattle placed in the same pathogenic conditions as 2,453 non-inoculated ones, 182 only, or about 2.71 per cent. among the first, and 660, or 26.90 per cent. among the second have contracted lung plague.

2. Out of 63 previously inoculated in the tail or by intravenous injection, and in which a second inoculation was practiced in a region rich in connective tissue (a deadly region), 61 have shown no local reaction, and 5 presented a slight inflammatory swelling, which in 6 beasts inoculated for the first time in the same dangerous regions, as test cases, all had an extensive inflammatory engorgement ending in death. Out of 6 animals inoculated by intravenous injection in the jugular and afterward subjected to 17 inoculations in the space of 16 months, 4 proved unaffected, 13 had slight inflammatory reaction, and 1 only had a considerable engorgement which did not prove fatal.

The immunity secured by inoculation has lasted four and five years, as observed by Ziegenbein, in animals constantly exposed to infection, and for one year in 16 test cases in the experiments of the Central Society of Veterinary Medicine of Paris.

The drawbacks to the operation are :

1. All the inoculated do not acquire a perfect immunity.
2. Inoculation preserves and spreads the poison.
3. A certain small proportion die from the extensive swellings and gangrene consequent on the inoculation.

That all the inoculated are not protected is shown in the above statistics ; some highly susceptible animals still contract the disease as some men contract small-pox after vaccination. To secure a better im-

munity it is advised to make more careful selection of the virus from a lung engorged yellow and already slightly fibrinous, or from the subcutaneous connective tissue in an inoculated region rich in that tissue, to repeat the operation after a certain lapse of time, as advised by Willems, and with weakened virus to inoculate in a region rich in connective tissue. This, it is claimed, can be done safely with virus which has been kept six weeks in a hermetically sealed tube (Pasteur), or with what has been cultivated for a length of time in flasks in a special manner (Bruylants and Verriest). Virus diluted with 50, 100, and 500 times its amount of inert liquid still remained dangerous. (Vandermies: Central Society of Veterinary Medicine, Paris.)

The danger of the propagation of the disease by inoculation is really very slight. Yet he acknowledges the presence of the virulent micrococcus in the inoculation exudate, and advocates inoculation as a means of procuring pure virus for further *protective* inoculation.

To obviate the slight danger of lung infection through inoculation he advocates the use of attenuated virus (*à la* Pasteur, or *à les* Bruylants et Verriest) and the intravenous injection of the virus pure or attenuated. (It is to be noted that an *absolute immunity* is not claimed for any method, nor an *absolute protection against the propagation of the disease by the inoculated*; the claim is that these may be reduced to a very small figure. It follows that the protective inoculation is a measure of *repression*, not *extinction*, and to a case like ours, where a prompt *stamp-out* is imperative, it is quite inapplicable.) This is the more evident from Degive's opinion that "all inoculated animals are to be regarded as suspected of infection, and treated as such, and that after the completion of the operation all virulent products should be thoroughly destroyed or buried."

To obviate losses from inoculation he particularly advises the use of *attenuated virus* or intravenous injection, and to avoid the operation during hot and rainy seasons.

For the *destruction of the poison* it is necessary to attend to all fodder (which has remained infecting for 3, 4, and even 9 months), all articles about the stables, or suspected cattle, all other animals (not bovine) that have cohabited with them, all places (buildings, &c.) where they have been, all vehicles used for their conveyance or that of their products, and all persons that have come near them or the infected places. The infected herd, the carcasses, and fresh products must receive, of course, the first attention. Thorough destruction or disinfection of all these is absolutely essential.

As the discovery of infection is the corner-stone of success, it must be made obligatory on all owners and attendants on cattle, on all veterinarians and inspectors of abattoirs and meat markets, to promptly report all cases of the disease, under a heavy penalty for disobedience and for the owner a liberal indemnity for cattle and objects destroyed.

At his *visit* the official veterinarian must note the animals sick and

exposed, the source of the infection, what objects have become infected, what persons and animals may become vehicles of the virus, and what measures (especially isolation and killing) are required.

Inspection of fairs, markets, and herds in an infected district, and visit, every fortnight, of large stables, then having frequent changes, and those those that have been infected, are requisite.

Slaughter should be resorted to for the sick and all suspected of disease, no treatment being permitted. Recovered animals should in all cases be used for meat only. All slaughter of subjects out of an infected herd should be in the presence of as few persons as possible and under the inspection of a veterinarian. The animals suspected of being infected should be inoculated. (The provision against treatment should also preclude inoculation if extinction of the disease is desired.)

For indemnity as a means of securing early reports he advocates, at least one-half the sound value for beasts suspected, yet fit for human consumption, and at least three-fourths the sound value for those that are diseased and unfit for food. Better still to completely extirpate the infected herd and indemnify to the extent of the full value, as in Holland and England; the state to retain in such a case all proceeds from flesh and hide.

Under *isolation* come: (a) *Sequestration* in a particular place near which no other cattle nor other animals are allowed.

(b) *Cantonnement or parkage* in a secluded place inclosed by walls, hedges, barriers, palisades or water; and safely apart from roads, parks, &c., frequented by other stock.

(c) *Sanitary zones or circles*, including a part or whole of a village or commune or several communes, separated from all communication with outside districts.

(d) *Census and marking* are essential to a perfect control of such secluded places.

(e) *Prohibition of movement* of all sick and suspected animals is absolutely essential. Under special precautions fat cattle may be moved in closed wagons to slaughter, and work-oxen may be utilized on certain prescribed fields if there is no danger of communication with other cattle, direct or indirect; no cattle should be exposed for sale anywhere without an official certificate that no epizootic has existed for six weeks or more in the commune from which they were drawn.

(f) *Suspension of fairs and markets* is only demanded when the lung plague has attained to an extensive prevalence.

(g) *Importation of cattle should be interdicted* from any infected country unless they are accompanied by a certificate of health dated six days before and showing that no lung-plague has existed for at least six weeks in the place from which they came. (Such provisions show the aim at restriction rather than extinction of the malady, as they could not arrest the occult cases nor those having a long period of incubation.—J. L.)

(h) *Quarantine* of newly-bought animals for five or six weeks is an important precaution.

(i) *Posting notices of infection* at the entrance of infected zones or farms.

(j) *Handbills and instructions* for the people in or near the infected area.

(k) *Surveillance* with very frequent visitation by inspectors and police.

Preventive medication for animals exposed to infection may embrace *setons medicated with hellebore*, and *antiseptics*, such as ferric sulphate, alkaline sulphites, carbolic acid, borax, tar, chlorine.

All restrictions may be removed forty days after the last case of disease has been disposed of and the place and objects disinfected. (This is entirely inconsistent with what he has already advanced as to occult cases, chronic cases, and long periods of incubation which could so easily exceed twice the forty days required. It is another indication of an aim at restriction rather than extinction.)—J. L.

If *carcasses* have to be removed, this should be done in wagons with close joints, so that nothing shall escape, and drawn by horses under police supervision. The carcass and diseased products may be deeply buried, burned, rendered, or dissolved in sulphuric acid. It is often utilized for food, but this should be prohibited when the lung lesions are very extensive, advanced, and complicated by gangrene, when there is ulceration of the bowels, or when the flesh is flaccid, decolorized, ecchymosed, or the seat of serous infiltration. The *skin* may be sent to the tannery after steeping a length of time in milk of lime, or solution of chloride of lime, or zinc. or carbolic acid.

Disinfection of stables demands washing, scraping, and the thorough application of liquid disinfectants. Manure, fodder, and litter should be burned or disinfected, or the latter may be fed to horses. Horses and other animals that have been with diseased cattle should have their surface cleaned and disinfected by an antiseptic solution.

LEBLANC'S VIEWS.

Leblanc sought to throw doubt on the diagnosis of lung plague during life, on the specific character of the lesions seen in the carcass, and on the value of inoculation. Many inoculated animals have already had the disease and are protected by that; cases already infected before inoculation have the disease aggravated by the operation; the poison, and therefore the disease, is preserved and perpetuated in certain districts by the practice of inoculation; inoculation is no certain prophylactic, for just as in the same lung we see chronic lesions side by side with the acute, implying a second attack, so may an attack follow a successful inoculation; and finally, the same measures of segregation and slaughter usually employed with inoculation would be successful without that operation.

PUTZ'S VIEWS.

Putz does not hesitate to pronounce the physiological symptoms and pathological lesions as together reasonably pathognomic. He is a strong partisan of inoculation, provided the operation is repeated after a lapse of time, and above all if repeated again and again. It is useless or injurious for animals that are already infected, and the duration of the immunity acquired in successful cases varies with the individual susceptibility, as does vaccination for the prevention of small-pox. It is especially valuable in places where movements of great numbers of cattle are continually going on, and where sequestration is in consequence impossible. Where, on the other hand, there are few movements of stock the isolation and slaughter of the diseased and strongly suspected beasts is speedily effective. In Holland with inoculation the disease has been confined to the narrowest limits, while in most parts of Germany it has been stationary or increasing, and in Saxony with little inoculation it has in recent years attacked three times the number of victims seized in 1875-'76.

In addition to the measures of sequestration he advocates: 1. That the quarantine mark should bear the year so that it may be afterward known when they were diseased or suspected. 2. That all diseased and strongly suspected animals should be killed, and that the entire herd should be slaughtered when judged necessary, indemnity being granted for the same. 3. When, owing to frequent changes in a large herd, or when, from economical considerations such herd may not be slaughtered, the same should be compulsorily inoculated. Inoculation may be authorized in an infected country, if desired, by the proprietor, and consequent losses should be paid for. 4. Every beast from a quarantined herd which dies or is killed ought to be the subject of an autopsy by a competent person. With this precaution such cattle should be devoted to slaughter for beef as much as possible, no necessary precaution being forgotten.

ACTION OF THE CONGRESS.

A.—DIAGNOSIS.

The question of *diagnosis* of lung plague gave rise to a somewhat lengthy, animated, and fruitless discussion as to whether this disease *can arise spontaneously*, or whether *it is everywhere and always the result of contagion*. The advocates of a spontaneous origin of the disease acknowledged that the occurrence of a spontaneous case was extremely rare, and that in spite of spontaneous cases a system of repression, based on a constant assumption of contagion, was the best; yet they claimed, as already stated of Degive, that the malady may originate by the transformation of harmless germs into virulent ones, or it may be by the transformation of normal histological elements of the body into diseased elements having a power of propagating themselves indefinitely. The opponents,

on the other hand, held that the non-appearance of this disease in historic time, in any country in which it had not previously existed, unless in cases where its introduction could be clearly traced to the importation of a diseased animal or its products, and its continued absence from all countries into which no such importation had been made implied, unequivocally, that the assumed cases of spontaneity were also cases of infection, though investigation had failed to show the precise channel by which the germs had been introduced. A comparison of the nationalities of the advocates of spontaneity and against it is very instructive as showing that the believers in spontaneity are those whose experience has been gained at the termini of the cattle traffic from Central and Eastern Europe, at points (Belgium, France), in short, where the infection of lung plague is being constantly imported, and from which it is never entirely absent, whereas the disbelievers in spontaneity are mainly from countries (England, Sweden, Switzerland, Roumania, America, &c.), in which lung plague has been stamped out, or into which it has been first introduced in recent times by a well-attested importation of disease, and where its area of prevalence is sharply limited to places infected through such importations.

This well illustrates the predominating influence of the immediate surroundings. Had the able advocates of spontaneity lived in Spain or Portugal, where herds abound, but to which the lung plague has never penetrated, or in Scandinavia, where its occasional importations have been as persistently stamped out; or in Switzerland, the immemorial home of the plague, but from which it has been expelled; or in England, which it respected until it was imported in 1839 and where it has prevailed ever since, but still spares the exclusively breeding districts; or in the United States, where it was imported in 1848 and 1859, and where it was effectually stamped out in the fenced farms of New England but continues to prevail through the constant changes and successive infections in the city dairies of the Middle Atlantic States, and finally where the whole West and South maintains a perfect immunity; or in South Africa or Australasia, where the disease, long unknown, has spread from single importations and from the constant mingling of herds maintains an universal prevalence; or, finally, in Canada, Newfoundland, Mexico, or South America, to which the plague has not yet been imported and where, as in the exclusively breeding districts of infected countries, no *spontaneous* case has ever occurred to start it on its desolating career, they would have realized that they were advocating a mere phantom danger and that the plague which has failed to appear in historic time in a country not already infected from without may safely be trusted not to appear in the future with such exotic contagion. They would no more argue from the first case of the plague than the botanist would argue from the first oak that oaks must now appear without seed or slips; they would accept the unvarying testimony from all parts of the inhabited earth which are

not yet infected or which have been infected in historic time that every extension of this plague has been by contagion and by contagion alone.

On motion of Wirz the following was adopted as the first resolution :

1. From an anatomical point of view, at least in its relation to veterinary police, every pneumonia (of cattle) which is lobular and at the same time interlobular, and the development of which does not depend on traumatic local causes, should be considered as epizootic contagious pleuro-pneumonia.

The second resolution was modified by adding the word *contagious*, so that it might read :

2. From a physiological stand-point, epizootic contagious pleuro-pneumonia is specially characterized, in the living animal, by the contagious character and by the symptoms of lobar-pneumonia.

To the third resolution the following wording was given :

3. There ought to be considered as—

(a) Suspected of epizootic contagious pleuro-pneumonia every animal which in an infected place manifests symptoms of fever or of disease of the chest.

(b) Suspected of contamination every animal found in an infected stable, or which has been in one within three months, or which has been exposed to infection in any other way.

The fourth resolution was suppressed on motion of Lydtin and Wirz.

B.—PROPHYLAXIS.

On motion of Zundel and Lydtin the congress decided to take up first the question of stamping out.

On motion of the same, Article 2 was modified and finally passed so as to read as follows :

2. Recognizing that from the point of view of sanitary police epizootic pleuro-pneumonia propagates itself only by contagion, and is usually incurable and fatal, this congress declares that animals affected by the malady or suspected of it should be sacrificed as quickly as possible.

The third article was adopted with the single change of substituting contaminated for suspected of contamination or very much exposed to contagion, the word retaining the idea of exposed to contagion. It read thus :

3. Contaminated animals should be isolated or sacrificed. The slaughter of contaminated animals is especially indicated when the disease manifests itself very exceptionally or for the first time in a stable belonging to a commune rich in cattle.

On the question of the value of inoculation as a preventive, much discussion ensued, the great majority, however, according to it the power of protection to a certain extent. A number, however, of these last, and especially those who like Berdez (Switzerland), Law (New York), and others had had a favorable experience of stamping out, deprecated inoculation in any country where it was possible to promptly extirpate the plague by the radical measures of slaughter and disinfection. Wirz reported that of the 182,308 cattle inoculated in Holland, in the past four years (1878–1882) the losses from the operation had been under 1 per cent., and the protection had been satisfactory. Law repeated the inoculation of 10 cattle with sterilized virus which obviated

the danger of infection from the inoculated, and which, in a six-month's test, by inoculation with attested virulent lymph, and by residence in infected herds, had proved perfectly satisfactory. Willem's proposition that "all scientific interpretations being reserved no fact in practice has proved the contamination of a healthy by an inoculated animal" was voted down, and the following of Potteral adopted :

There is no proof that an inoculated animal cannot transmit the disease to a healthy one.

The following, moved by Bouley, was adopted :

3. We have to-day experimental proof that it is possible to invest the organism of animals of the bovine species with an immunity from contagious pleuro-pneumonia by inoculation with the virus of this malady.

Two applications of inoculation were recognized—preventive inoculation (inoculation in the absence of the disease), and inoculation of necessity, (inoculation of animals dangerously exposed to infection). As an amendment to Article 4 the following was passed :

4. Preventive inoculation, that is to say, that which is practiced where the malady does not prevail in a country, ought to be absolutely rejected ; inoculation, so called, of necessity, that is to say, that which is practiced when the malady exists in a herd, may be permitted, but not made obligatory.

On the motion of Wirz, Article 5 was stricken out; Article 6 was modified so as to read :

6. The inoculation should always be done by a veterinarian.

Article 7 was dropped.

On Degive's motion Article 8 was altered to—

8. Inoculated animals should be reported to the authorities.

Articles 9 to 13, inclusive, were not called in question. On motion of Müller the following was adopted :

14. The duration of quarantine should be six months at least after the disappearance of the disease.

Articles 15 to 19, inclusive, were not objected to.

On motion of Lydtin, Müller, and Potteral, Article 20 was altered as follows :

20. A stable should not be used again for animals until it has been completely evacuated and properly disinfected, and then purified by eight days' exposure to free ventilation.

On motion of Bouley and Aune, Article 21 was altered as follows :

21. Pastures that have been frequented by diseased animals ought to be quarantined for at least fifteen days.

Articles 22 to 24, inclusive, were passed.

On motion of Quivogne, Potteral, and Lydtin, Article 25 was modified as follows :

25. It is proper to grant an indemnity to owners for animals sacrificed by official order, and for the expense of disinfection. The indemnity should amount to four-fifths of the value of the animals; and to the full value, deduction being made of the value of portions of the carcass that can be utilized if the animal should prove healthy.

Articles 26 to 28 were adopted without question.

REMARKS.

Without seeking to detract from the importance of any one position taken by the congress, it may still be well to emphasize some that have a special value to the American statesman.

1. The extension of the incubation of lung-plague for months, and the frequent occurrence of occult and unrecognized cases of the disease, show how essential it is to stop all movement of animals in infected districts, except under license, after an extended supervision, including statistics constantly corrected; also to kill out an entire infected herd, or to maintain the above-named strict supervision for a long period (six months); also, to prohibit the contact of adjacent herds in neighboring parks, &c., and their successive presence in the same pastures, on the same roads, or at the same drinking troughs. These dangers are just those of which it has been most difficult to persuade our United States legislators and our non-veterinary administrators of State sanitary laws, and on the fundamental blunders made on these points depend our failure hitherto to extirpate lung-plague.

2. The idea of the spontaneous origin of lung-plague in the present day is effectually set aside. An abiding confidence in our perfect security from this disease apart from imported virus is essential to thorough work. Whenever the possibility of spontaneous cases is admitted this will be made a cloak for slovenly and ineffective work.

3. The voice of the representative veterinarians of Europe and America has been given against the assumption that inoculated animals cannot infect a sound animal. This is a decision of no small importance, as this operation of inoculation is extensively practiced among us, and though it enables the individual owner when left to his own resources to save the great body of his herd, yet when the state undertakes to stamp out the plague, its practice becomes a serious hindrance by increasing and diffusing the virus.

4. In spite of the difficulty or impossibility of controlling the enormous cattle traffic which is constantly flowing westward through the center of Europe, and the consequent temptation to adopt measures of *repression* and *restriction* rather than those of *extinction*, the congress declares strongly in favor of the instant slaughter of all diseased animals and of those suspected of disease. How much more should we who have to deal with but a mere patch of inspection relatively to our territory promptly destroy every animal and every herd in which infection is found?

5. Even in Europe the veterinary sanitary authorities feel that action by isolated states aiming at the suppression or extinction of lung-plague is woefully ineffective, and they demand that the veterinary sanitary police administration shall overstep the national boundaries and be made continental, to the extent that the different nations shall agree upon a uniform law, under which the disease shall be promptly stamped out

or honorably and effectually shut up in any district where it may appear, so that an official certificate may give an absolute guarantee of soundness. How much more should the United States, bound into one nation and having one common Federal legislative body, and one Federal administration, arrange for a single law on this subject for all the States and Territories and for its uniform administration, whether through State or national officials? Hitherto the varying laws in different States have been a source of constant uncertainty, trouble, and loss to dealers, and yet no certain guarantee against the extension of the plague from State to State.

6. In dealing with an insidious affection like lung-plague the veterinary profession in Europe realize the necessity of adopting every means calculated to secure information of outbreaks, and the restriction of surreptitious movements of animals; they accordingly declare in favor of indemnity to four-fifths of the sound value for sick cattle sacrificed and the full value for cattle exposed to infection but not yet diseased, and also for heavy penalties for all failures to comply with the law. In our own State of Pennsylvania, infected herds have been taken possession of by the State, and all that subsequently sickened have been paid for at full appraised value, with results incomparably better than where the law has been to give small indemnities and impose large penalties. Our legislators should realize from this combined experience of Europe and America that niggardly indemnities mean concealment, smuggling, and extension of the disease, while with liberal remuneration for the cattle taken the disease may be stamped out at a mere fraction of the outlay that would otherwise be necessary. In city dairies, where most of our lung-plague is to be found, the full value of the animals killed is far from compensating the owner for the interruption of his business until his herd and stables can be pronounced sound. No economy is more false than that which saves on the payment for infected cattle slaughtered at the expense of concealment and surreptitious diffusion of the disease.

3. EDUCATION IN VETERINARY MEDICINE.

This subject was introduced by two separate reports—one by Hugues, of Brussels, the other by Professor Wirz, of Utrecht, and Müller, of Berlin.

HUGUES' REPORT.

A.—Education in veterinary medicine and the social position of the veterinarian demand a thorough preliminary instruction corresponding to the classes in humanity or the complete professional ones.

B.—Education in veterinary medicine should be theoretical, scientific, practical, experimental, and educational, in giving to each of these the relative importance which the real needs of professional work demands.

To this end we ask—

1. That the studies should extend over five years.

2. That the exterior of domestic animals be made the subject of an essentially practical course, of which the study of animal mechanics shall be the basis.
3. That there ought to be created in every school a course of equitation.
4. That exercises at the forge should be abolished.
5. That the course of special pathology should be abolished.
6. That there should be theoretical and practical instruction in the inspection of alimentary matters of animal origin.
7. That there should be at least two professors of clinics in each school.
8. That a residence outside the walls (external) should be obligatory at least for the last two years of study.
9. That a period of probation (stage) be imposed as complementary to the school studies.
10. That practitioners should be made part of the examining boards.
11. That the appointment of professors should be made on the double basis of *con-cours* and of scientific reputation; that assistants or tutors should be nominated on the proposition of the professional college.

While we cannot follow Hugues through his elaborate report, yet we may cull a few of the points made in favor of his propositions.

A liberal profession is marked by solidarity; it is cosmopolitan, knows no territorial frontier, no nationality; it is the product of civilization, and protected by universal science. The liberal profession of medicine is one; its methods only differ according to the species to which it is applied. The two professions of medicine—human and veterinary—are sisters, equally liberal, and demand an equally extended preliminary training and give an equal right to consideration. To secure this equality the education for the one must be as thorough as for the other, alike in its literary, scientific, and special features.

Continental Europe has thirty-three well-equipped veterinary schools, each a Government institution, controlled and supported by the state. Great Britain has four veterinary schools, none of which is under state support nor control aside from the charters under which they are maintained. In England and Austria the course of study extends over three years; in Germany and Switzerland, three years and a half; in France, Belgium, Holland, Denmark, Sweden, Russia, and Italy, four years; and in Roumania, Spain, and Portugal, five years.

As an example of the curriculum, that of the Brussels school will alone be given.

VETERINARY SCHOOL OF BRUSSELS.

FIRST YEAR—WINTER SEMESTER.

Descriptive anatomy, $1\frac{1}{2}$ hour per week.	Botany, 3 hours.
Dissections, 9 hours.	Examination in chemistry or physics, $1\frac{1}{2}$ hour.
Tuition in chemistry or physics, $1\frac{1}{2}$ hours.	
Lectures in chemistry or physics, $4\frac{1}{2}$ hours.	

SUMMER SEMESTER.

Botany, $4\frac{1}{2}$ hours.	Zoology, 3 hours.
Botanical excursion.	Tuition in descriptive anatomy, $1\frac{1}{2}$ hour daily.
Tuition in botany, $1\frac{1}{2}$ hour.	Examination in chemistry or physics, $1\frac{1}{2}$ hour.
Chemistry or physics, $4\frac{1}{2}$ hours.	
Tuition in chemistry or physics, $1\frac{1}{2}$ hour.	

SECOND YEAR—WINTER SEMESTER.

Tuition in chemistry, $1\frac{1}{2}$ hour.	Descriptive anatomy, 3 hours.
Tuition in physics, $1\frac{1}{2}$ hour.	Dissections or exercises in histology, $4\frac{1}{2}$ hours.
Examination in chemistry or physics, $1\frac{1}{2}$ hour.	Dissections, 15 hours.
General anatomy and physiology, $4\frac{1}{2}$ hours.	Physics or chemistry, $4\frac{1}{2}$ hours.
Tuition, general anatomy and physiology, $1\frac{1}{2}$ hour.	Comparative anatomy, $1\frac{1}{2}$ hour.

SUMMER SEMESTER.

Tuition in physics or chemistry, $1\frac{1}{2}$ hour.	Comparative anatomy, $1\frac{1}{2}$ hour.
Tuition in chemistry, $1\frac{1}{2}$ hour.	Tuition in comparative anatomy, $1\frac{1}{2}$ hour every 15 days.
Tuition in general anatomy or physiology, $1\frac{1}{2}$ hour.	Work at the forge (<i>maréchalerie</i>) 3 hours.
Work in histology, $4\frac{1}{2}$ hours.	Examination on chemistry or physics, $1\frac{1}{2}$ hour.
Physics or chemistry, $4\frac{1}{2}$ hours.	
General anatomy and physiology, $4\frac{1}{2}$ hours.	

THIRD YEAR—WINTER SEMESTER.

Clinics, 2 hours daily.	Exercises in operative medicine (surgery), 3 hours.
Pharmacology, 3 hours weekly.	Exterior (form), 3 hours.
Tuition in general anatomy and physiology, $1\frac{1}{2}$ hour.	Tuition on exterior, $1\frac{1}{2}$ hour every 15 days.
Theory of shoeing, $1\frac{1}{2}$ hour.	Special therapeutics and pharmacodynamics, 3 hours.
General pathology, and special and pathological anatomy, $4\frac{1}{2}$ hours.	Topographical anatomy, $1\frac{1}{2}$ hour.
Tuition in general and special pathology, and pathological anatomy, $1\frac{1}{2}$ hour.	Work at forge, $1\frac{1}{2}$ hour.

SUMMER SEMESTER.

Clinics, 2 hours daily.	Pharmacology, $1\frac{1}{2}$ hour.
Operations on the foot, $1\frac{1}{2}$ hour per week.	General therapeutics and pharmacodynamics, $1\frac{1}{2}$ hour.
Operative medicine, $4\frac{1}{2}$ hours.	Pharmaceutical manipulations, $1\frac{1}{2}$ hour.
Demonstrations in pathological anatomy, $1\frac{1}{2}$ hour.	Tuition in general pathology and special pathological anatomy, $1\frac{1}{2}$ hour.
General pathology and special and pathological anatomy, $4\frac{1}{2}$ hours.	Zootechny, 1 hour.
Tuition in clinics, $1\frac{1}{2}$ hour.	

FOURTH YEAR—WINTER SEMESTER.

Clinics, 2 hours daily.	Work at forge, 3 hours.
Tuition, clinical, $1\frac{1}{2}$ hour per week.	Zootechny, $1\frac{1}{2}$ hour.
Surgical pathology, $4\frac{1}{2}$ hours.	Tuition in surgical pathology, $1\frac{1}{2}$ hour.
Pharmaceutical manipulations, 3 hours.	Constitutional law, $1\frac{1}{2}$ hour.
Obstetrics, $1\frac{1}{2}$ hour.	Equitation, 4 hours.
Practical operative medicine, 3 hours.	

SUMMER SEMESTER.

Clinics, 2 hours daily (2 hours weekly clinics in chair).	Zootechny, 3 hours.
Work at forge, $3\frac{1}{2}$ hours.	Examination of meats, $1\frac{1}{2}$ hour.
Pharmaceutical manipulations, 3 hours.	Zootechnic conferences, 1 hour.
Tuition, clinical, $1\frac{1}{2}$ hour.	Tuition in zootechny, $1\frac{1}{2}$ hour.
Medical jurisprudence and sanitary police, $1\frac{1}{2}$ hour.	Equitation, 4 hours.
Tuition in surgical pathology, $1\frac{1}{2}$ hour.	Tuition in medical jurisprudence and sanitary police, $1\frac{1}{2}$ hour.
	Constitutional law, $1\frac{1}{2}$ hour.

Others of the schools, and notably those of France, give instruction in modern languages and literature, which Hugues holds should be obtained before entering the veterinary school. To further relieve the curriculum and give more time to the exclusively professional studies, he would abolish the class on constitutional law, that on shoeing, and even that on special pathology as taught from the chair, thus throwing the student back on books and clinical teaching for instruction in the practice of medicine. The need of some relief is well illustrated in the fact that a large proportion of students to-day exceed the allotted period of study preliminary to taking a degree. Thus at Brussels in former times a failure to pass in four years was altogether exceptional, while under the modern crowding of studies but 33 out of 77 students have passed in this prescribed period; of the remaining 44 students 20 took five years, 20 six years, 1 seven years, and 3 eight years.

The curriculum has greatly outstripped the ability of the student to cope with it, and the two should be adjusted so that the majority may be able to graduate in the prescribed period. Though something may be done in eliminating subjects that are not purely professional, yet, with the rapid advancement of science, the exclusively professional work incumbent on the student tends constantly to increase, and the strain must be met by securing a better preliminary training, and by extending the curriculum to five years. Thus, for admission to the school, a knowledge of one or more modern languages should be demanded; those of the adjoining countries being always valuable as giving a key to their literature and as being essential in the administration of sanitary police. The rudiments of Latin are very useful, but not indispensable. National and foreign literature have no occasion to appear in the curriculum, and should not be a condition of entrance. So of mathematics and the natural sciences. If the same could be applied to physics and chemistry it would be well, but this would be asking too much of a boy of seventeen, and would endanger superficiality in all.

Then if the curriculum were extended to five years, the present double examination might be profitably extended to three; the first in sciences, the second as candidate in veterinary medicine, on anatomy, physiology, histology, physics, chemistry, and perhaps the exterior, and the third . . . one, pathological biology, therapeutics, surgery, clinics, hygiene, zoo-technics, sanitary police, &c.

The examining boards should be composed of the faculty of the school and a certain proportion of veterinary practitioners. This will tend to correct any tendency in the schools to a too exclusive attention to scientific minutiae at the expense of the even more important matters of daily practice, and give a special value and guarantee to the examination and diploma. On the other hand, the intimate knowledge of the candidate on the part of the professor will enable the board to qualify

the results of a hurried examination by the record of five years of continuous work.

In the appointment of teachers much is required. The professor should be a man of high morality, one inspiring respect and esteem, who knows his subject thoroughly, and who yet can condense it to the demands of the case, and present it clearly, plainly, and concisely, yet in such a way as to engage the enthusiasm of his students. He may be a good professor without being a *savant*, and he may be a real *savant* yet a very poor professor. To know and to teach are different things. A mind quick to write, subtle in the analysis of facts, facile in the assimilation of all contemporary progress, a ripe judgment, the power to present the analysis or synthesis in the form of a clear attractive résumé; these are the essential qualities, the rôle and mission of the professor. He must besides have such a knowledge of the entire curriculum as will enable him to direct his work parallel to that of his colleagues without exposing himself to contradiction, or unnecessary repetition by another chair. To successful teaching there must be a unity and harmony in the entire field of work. This necessitates that every professor in a chair bearing directly on specific veterinary instruction should be himself a veterinarian.

In the appointment of professors regard should be had to the aptitude for scientific work already shown by the candidate, and the aptitude to teach, as shown experimentally before a *concours*. The *concours* alone in which the candidate is made to exhibit his teaching powers practically may often select the fluent but superficial man and reject the real scientist, as it has actually at different times rejected the illustrious Bichat, the creator of microscopical anatomy, Claude Bernard, the founder of general physiology, and Dupin, the learned procurator-general of the court of causation. But, as corrected by reputation for work done outside the *concours* the latter becomes a means of the highest value in selecting a man who joins superior didactic power to a profound scientific knowledge and acumen.

Tutors should only be chosen from graduates, in which case the excellence in examination should coincide with the judgment of the professor in charge of the department in making the selection. When professors are recruited from the ranks of the tutors they should have the experience of several years' practice.

REPORT BY PROFESSORS MÜLLER AND WIRZ.

Müller and Wirz indorse in the main the principles enunciated by the International Congress at Zurich in 1867, but propose certain modifications. The Zurich resolutions were as follows:

1. The preparatory studies should be as extended for veterinary medicine as for human medicine. It is desirable that we should, as far as possible, demand for entrance to the veterinary schools the same knowledge as for the university studies.

Since, for various reasons, we are not yet able to enforce such a rule, the congress is of opinion that the minimum knowledge preparatory to the special studies of veter-

inary medicine should correspond to those acquired in the second (class) of a school preparatory to university studies.

Those who have not pursued the course of such an institution should not be admitted to the special veterinary studies until they prove that they are possessed of an education corresponding to that of the class above named.

2. Three years of special studies at least are necessary to secure the rank of veterinarian.

There is no call for the creation of veterinarians of different classes based on differences in the degree of instruction.

3. Veterinary schools may be separate, independent establishments, or joined to by universities or other institutions of higher learning, but their instruction should be special chairs. We cannot but condemn the arrangement in which a single professor is charged with the duty of educating veterinarians, this mode of teaching being absolutely insufficient.

4. An organization of the instruction conformed to the above principles should be adopted above all when the practice of veterinary medicine is well established and regulated.

PROPOSITIONS OF MÜLLER AND WIRZ.

I.

1. The preparatory studies demanded for the study of veterinary medicine ought to be the same as those exacted of the student of human medicine.

2. As for various reasons this first principle cannot yet be enforced, we ought at least to require that all who wish to enter on the study of veterinary medicine should *at least* possess the acquirements necessary to admit them to the highest classes of a superior school giving an ordinary good education.

As an institution giving an ordinary good education, we mean those schools which give a right to students that have completed their course to admission to the higher or university studies. (Gymnasiums, lycæums, atheneûs, Latin schools, colleges), (and superior professional schools, *Realschulen, erster ordnung*, of Germany), (Wirz and Müller), in which Latin is obligatory (Müller).

3. Candidates unprovided with a certificate of admission to the first class of one of these schools should show by a special examination that they are possessed of an equivalent education.

II.

There is no call for the creation of veterinarians of different classes having a different amount of preparatory and veterinary education.

III.

1. Four years' study, at least, are requisite to make a full study of veterinary medicine, if that is made to embrace physical and natural sciences.

2. The instruction of the first two years (four first semesters) should embrace the following branches: physics, chemistry, natural history (geology, mineralogy, botany, and zoology), anatomy, histology, physiology, and shoeing, with the practical work attaching to them. A course of practice and demonstrations in micrography should always be included.

3. In the same period may be taught the zootechnic branches, comprehending the natural history of domestic animals, the exterior, and zootechny proper.

4. Clinical teaching should continue through the whole of the last two years of study. That the practical instruction of the students may be complete it is absolutely necessary to have beside a stationary and consulting clinic (hospital clinic and poly-clinic), an ambulatory clinic (outside clinic).

5. Practical instruction in shoeing cannot be condemned as useless, but it ought to be limited to the end proposed; this instruction is on the whole very desirable.

6. The inspection of meats of the butchery is an absolutely essential branch of veterinary education.

IV.

1. At the end of the second year of study (fourth semester) the students ought to be examined on the branches they have studied during the two preceding years. None should enter on the studies of the third year until he has satisfactorily passed this examination (of candidate, or in physical and natural sciences).

2. None should be admitted to the examination for veterinarian until he has passed that of candidate in veterinary medicine.

(The examination in veterinary medicine should embrace only those branches which have not formed part of the candidature examination.—*Wurz.*)

(The examination in veterinary medicine should embrace, beside anatomy and physiology, all branches of instruction not included in the examination of the candidate.—*Müller.*)

3. The regulations for veterinary examinations should, as far as possible, be absolutely, or at least essentially, the same for all countries.

V.

1. The system of residence in the school (internal) is not the best for the pursuit of veterinary studies and the social education of veterinarians.

2. If peculiar circumstances, proper to any country, forbid the abolition of residence (internal), the students should at least be allowed entire liberty outside the prescribed course; the control of the internal ought to be as liberal as possible.

3. Obligatory "internal" should be abolished.

VI.

Veterinary schools may be independent establishments, or they may be connected with universities or institutions for the higher education; but veterinary medicine should have its special chairs. One cannot but disapprove of institutions in which all branches of veterinary education are divided in a very limited number of university chairs; such a system is absolutely insufficient.

VII.

1. Professors in veterinary schools should be possessors of veterinary diplomas; an exception to this rule may be admitted in the case of those teaching the preliminary courses of physics and natural sciences.

2. It is very desirable that veterinarians before being called to a professorship should have practiced veterinary medicine for some years.

3. The diploma of physician or M. D. should not in itself render the holder eligible to a veterinary professorship.

4. The professors ought to be selected by preference from among the assistants, and upon the proposition of the faculty of the school in question.

5. Finally, to be able always to complete the professional body, there ought to be created numerous places for assistants.

REASONS.

As the requirements for entering the university are more than can at present be enforced, and more than is always required for the study of medicine, for polytechnic schools, schools of mines, &c., they should not

be required at present. The same conditions of admission should be maintained in all veterinary schools, and for all students, national or foreign, for all, indeed, who do not attend as simple auditors. The entrance examination should be made before a commission of the faculty who best know the acquirements requisite for the pursuit of the study.

Since the Zurich congress the great additions to veterinary studies in practical chemistry, micrography, &c., necessitates the extension of the course to four years at least. Wirz thinks even five years desirable.

Hugues' proposal to abolish the chair of special pathology is untenable. So long as the clinic does not furnish abundance of material to show and demonstrate to all the students cases of every disease it is impossible to agree to his proposal.

While recognizing how much veterinary medicine is indebted to human medicine, they cannot admit that the knowledge of the one fits for the teaching of the other. Medical professors are far from comprehending all the requirements of veterinary education, or the exigencies of veterinary practice. Most of them continue ignorant of these from lack of inclination as much as lack of opportunity, and the education suffers proportionally. For professors and assistants alike a veterinary diploma is a *sine qua non*.

ACTION OF THE CONGRESS.

After discussion the following was adopted as the first proposition:

1. For admission to veterinary studies one must be bachelor *ès lettres* or *ès sciences*, that is to say, he must have finished the studies of the secondary education.

The second proposition of Müller and Wirz was adopted, and reads:

2. There is no call for the creation of veterinarians of different classes, having a different amount of preparatory and veterinary education.

The third proposition was adopted with modifications of the second paragraph, so as to drop all reference to practical work, and of the fourth paragraph, so as to provide for two clinical professors in each school, and by the dropping of paragraphs 3 and 5. As altered, it reads thus:

3. Four years of study at least are requisite to make a full study of veterinary medicine, if that is made to embrace physics and natural sciences.

(a) The instruction of the two first years (four first semesters) should embrace the following branches: physics, chemistry, natural history (geology, mineralogy, botany, and zoology), anatomy, histology, physiology, and shoeing. A course of practice and demonstrations in micrography should always be included.

(b) Clinical teaching should continue through the whole of the last two years of study. That the practical instruction of the students may be complete it is absolutely necessary to have besides a stationary and consulting clinic (hospital clinic and polyclinic), an ambulatory clinic (outside clinic); there ought to be at least two professors of clinic.

(c) The inspection of meats of the hutchery is an absolutely essential branch of veterinary education.

The fourth proposition was modified by adoption of a motion by

Quivogne and Larmet to have yearly examinations, by one by Wehenkel to make a two years' clinical course obligatory, and by one by Eraers and Leblanc that examining boards should be composed of professors and practitioners. As adopted, it reads thus :

4. At the end of each year the veterinary students should be examined on the studies which they have been taught that year; no one should be allowed to follow the course of the advanced year without having passed this examination.

No one should be admitted to examination for the degree of veterinarian who has not followed a course of clinical instruction for two years after having passed the examination of the second year of study.

The board of examiners for conferring grades should always be formed partly of professors and partly of practitioners.

On motion of Quivogne proposition third was altered to :

5. "Internal" and "external" are optional in veterinary schools.

Proposition 6 was adopted unchanged, and on motion of Wirz, Fleming, and Laiutard, an expression in favor of the maintenance of all veterinary schools by the state. As adopted it reads :

6. Veterinary schools may be independent institutions, or they may be connected with universities or institutions for the higher education, but veterinary medicine should have its special chairs. One cannot but disapprove of the creation of those institutions in which all branches of veterinary education are given in a very limited number of university chairs. Such a system is absolutely insufficient.

It is very desirable that in every country the veterinary schools should be state institutions.

Proposition 7 was altered by a proposition of Quivogne to omit the second portion of paragraph 1, which effectually suppressed paragraph 3; and one by Wirz to drop paragraphs 4 and 5 as affected by particular local conditions and unsuited for a general decision. As adopted it reads :

7. The professors of veterinary schools ought to possess diplomas of veterinary medicine.

It is very desirable that veterinarians before being called to the professorship should have practiced veterinary medicine for some years.

REMARKS.

The first thing that strikes one in connection with this subject is the contrast between the Old World and the New. Europe seeks to protect her animal wealth by the creation and maintenance of thirty-three state veterinary colleges. The United States, with practically the same area, and with a wealth in live stock which is fast making her the meat market of the world, has not a single institution of the kind supported and controlled by State or Federal Government. Europe has learned, by a sad experience with animal plagues, that her only safety consists in the creation of educated veterinarians by maintaining a sufficient number of thoroughly efficient establishments, the diplomas of which shall be sufficient guarantee of the knowledge and ability requisite to carry on an effective veterinary sanitary service to care for the cavalry and artillery horses, and to provide everywhere the men wanted for the treatment of her flocks and

herds. In the United States, in the absence of any Government college, the public demand for veterinarians has led to the establishment of schools as private enterprises, some of which, like the earlier schools of Boston and Philadelphia, have prostituted their charters by making it a mere expedient for the sale of diplomas to all who would pay the price, irrespective of education or fitness, while others have filled their chairs with men who were themselves destitute of a veterinary diploma, and made them veterinarians by bestowing the diploma of their own institution. The result is that the country swarms with empirics, and that even the possession of a diploma is no guarantee of education or ability. If suddenly called upon to stem a great wave of infection among animals it would be no easy matter for this country to speedily provide the necessary men who could be relied upon for the work. If, again, it were necessary to secure the public health by the suppression in animals of plagues communicable to man, such as anthrax, tuberculosis, glanders, and farcy, milk-sickness, aphthous fever, diphtheria, trichinosis, &c., we have no State accredited school from which we could draw the requisite experts. Physicians are not instructed in the diagnosis and management of these affections in animals, and what have we done to secure reliable veterinarians? The numbers of our horses and cattle are two-fifths those of Europe—the British Isles included—and the number of our sheep and swine is over one-third of those of Europe, including the same islands.

Our latest census makes the value of our live stock in quadrupeds \$1,500,000,000, which is, doubtless, like all official valuations, considerably below the mark. This great moneyed interest, liable to injury by plagues, which tend to increase in geometrical progression, is left without that protection which should have its foundation in a national or State guarantee of veterinary education. Such a guarantee cannot be secured by granting charters. These have too often been made the mere occasion of the prostitution of the science to mammon-worship. To furnish it the institution must be placed above the temptation to acquire, and indeed beyond the possibility of acquiring, means by sacrificing the profession. This may be secured by making the veterinary college part of a well-endowed university, and subject to the laws of the same, or it may be made an independent national or State veterinary school, like most of the schools of Europe, under such laws as will preclude the entrance of the debasing influence referred to.

In view of the foregoing recommendations of the international congress, it would be superfluous to enter into the organization of veterinary schools and their curriculum. It may, however, be well to give some further data as to the facilities furnished in the European veterinary schools. It may be permitted me also to hint that we in America cannot abate one jot of the provisions made for this education in Europe, but rather increase them. In sixteen years since the congress at Zurich it has been found necessary in Europe to demand an increase of the period of study by one-third, because of the increasing extent of the

fields to be studied. In addition to all this we are to-day confronted by the great question of the life-history of disease germs, which opens up a new world in pathology, and which can be nowhere so appropriately investigated as in a veterinary college. This the Government owes at once to the great live-stock interests of the nation, and to the cause of sanitary science as applied to the human population. The maladies transmissible between man and animals must be investigated through the latter, and from this man will profit directly by the restriction or extinction of these affections, and, indirectly, by analogies with the newly discovered truths in the case of other affections peculiar to the human race.

In five of the state veterinary colleges of the Continent which I have visited the grounds cover a large area, though situated in a city, as at Berlin, Utrecht, Brussels, and Lyons, and are provided with dwellings and offices for the faculty, library, boarding accommodations for students, museums, dissecting-rooms, rooms for autopsies, laboratories for physics, chemistry, pathological anatomy, microscopy, and biology, pharmacy, lecture-rooms and instrument and retiring-rooms for the different departments, surgical operating theaters, furnace for burning infecting products, horseshoeing forge, halls for clinics (averaging 350 by 30 feet each), provided with forge, means of fastening for operations, &c., and separate buildings for the accommodation of the different kinds of hospital patients (solipeds, cattle, sheep, and swine and dogs), and with special stables for those of each kind suffering from contagious diseases. These last were paved with granite or hard-burned bricks, set in cement, and lined for 8 feet from the floor with enameled tile, set in cement, while all the fittings (stall, rack, manger, &c.), were of iron to facilitate disinfection. Then each school had its botanical garden, and in some the different field crops were cultivated, and several specimens of each of the best breeds of domestic animals of the same or adjacent countries were kept for purposes of instruction.

These state veterinary schools further have bursaries for poor but deserving students, the French Government providing no less than 240 of these under conditions which demand excellence alike in deportment and study. The minister of war can further send a certain number of students (in France 60) to be educated free for service in the cavalry and artillery.—J. L.

4. THE RIGHT OF VETERINARIANS TO FURNISH MEDICINES FOR THEIR PATIENTS.

This subject, introduced by Rossignol, apropos of a recommendation of a commission of the French legislature to abolish this right, was shortly discussed, and after securing a statement from the attendant representation of each country in Europe and America, as to the practice in that country, the congress decided as follows:

1. Considering that veterinarians are initiated by the technical studies pursued in their schools into the posology which pertains to the administration of medicines destined to the different species of animals;

2. Considering further that from this point of view they possess better guarantees than do druggists against the dangers which result from erroneous prescriptions;

3. Considering that the right to prepare and sell medicines, especially destined to the treatment of diseased animals, is indispensable for veterinarians who have ready all the medicines necessary for the treatment of the animals to which they are called, and who can furnish the same to their employers at a low price;

4. Considering that a law prohibitive of this is not only useless but opposed to sound economy—

The international congress expresses its opinion that in all countries veterinarians should have the right to prepare and sell medicines destined to the treatment of diseased animals, at least within the limits of their practice, and that it should be forbidden to empirics to keep pharmaceutical substances.

5. TUBERCULOSIS IN ANIMALS.

This subject was most extensively and ably treated by Lydtin, of Carlsruhe, reporter of the commission appointed to bring it before the congress. Unfortunately so much time had already been consumed on the preceding subjects that the congress could not give it the full and deliberate consideration which its overwhelming importance demands. Its full consideration may therefore be held to be deferred until the next veterinary congress shall meet in Paris, when the increased knowledge of the disease will doubtless strengthen views which may to-day be looked upon as in some respects premature. Meanwhile a summary of Lydtin's excellent report, and the action of the congress on it, cannot fail to have a high value. It concludes by proposing for the adoption of congress the following resolutions:

1. Tuberculosis is transmissible hereditarily.

2. It is contagious.

3. It should be included among affections which should be opposed by measures of sanitary police.

4. The measures that ought to be adopted for this purpose are the following:

(a.) Every owner of domestic animals must report promptly to the authority charged with this police service every case of tuberculosis, and any symptom causing suspicion of the existence of this affection; he must keep every animal attacked or suspected out of any place where it may be able to transmit the malady.

The same obligation should be incumbent on the steward, or representative of the proprietor, on the person conducting a herd or flock in transit, also on the proprietor of a stable, yard, pasturage, or park where animals are temporarily received.

This report is equally obligatory on veterinarians, and on any person who practices by profession the art of veterinary medicine, on meat inspectors, and upon every person engaged in the trade, of the destruction, utilization, or manipulations of cadavers or their products, if before all intervention of the police he discovers the existence of tuberculosis, or recognizes symptoms which lead him to suspect the presence of this malady.

(b.) The appearance of the affection and the particular herd infected ought to be published.

(c.) The suspected as well as the diseased animals should be sequestered, and their slaughter ordered by the police, animals suspected of being infected should be kept in quarantine, unless there are comparatively few, in which case they should be

slaughtered by official order. If a large number are suspected, they may be fattened and sent to the abattoir as quickly as possible.

(d.) Infected stables and other places should be under the special surveillance of the police for an entire year, counting from the last case of the disease. The sale of beasts suspected of infection should be interdicted, unless it is for slaughter, and under the inspection of a veterinarian.

(e.) The place occupied by a tuberculous animal ought to be cleansed and disinfected, the animal having been previously removed; it ought to be the same when the malady has disappeared from stables and other closed places in which tuberculous animals have been kept; it is only after disinfection that the prescribed police measures should be removed. During the whole course of the panzootic the stables should be especially well ventilated.

(f.) The flesh and viscera of a tuberculous animal can only be utilized for consumption when the disease is found *in the cadaver* in its incipient stage, when the lesions are confined to a very small portion of the body, when the lymphatic glands are still free from all morbid tuberculous lesion, when the tuberculous formations have not yet undergone softening, when the flesh presents the characters of meat of the first quality, and when the animal is in a good state of nutrition at the time of slaughter.

It should not be permitted to remove the flesh of tuberculous animals, admitted to consumption, out of the locality where they have been slaughtered, and it should not be offered for sale in the ordinary butcher's stall.

Every quarter of meat and all viscera showing lesions of tuberculosis, as well as the flesh of any other animal in which there is found at the necropsy a tuberculous infection more pronounced than that referred to above, should be watered with petroleum oil, and afterward buried under police supervision. The extraction of fat by cooking and the utilization of the skin may be permitted.

The inspection of every animal attacked by tuberculosis should be made by a veterinarian, who alone should decide if the flesh is fit for human consumption.

(g.) The milk of animals suffering from tuberculosis, or suspected of it, should not be consumed by man nor certain animals. The sale of such milk should be severely interdicted. The milk of animals suspected of infection should only be used after boiling.

(h.) Under proper safeguards against its abuse, it would be proper to furnish indemnities for cattle slaughtered by official order in consequence of tuberculosis, also for those that have died from this malady, and for those found to be tuberculous after they have been killed for human food. The indemnity may be paid out of the state treasury, or to create the requisite funds resort may be had to an obligotary insurance.

(i.) Violations of orders relative to measures preventive and repressive of tuberculosis should be punished.

(j.) As a safeguard of the public health against the dangers which threaten it through the consumption of flesh furnished from diseased animals, of stale or putrid meat, and of falsified sausage and mince-meat there should be established in every commune a competent service for the inspection of meats.

(k.) Establishments which make a specialty of furnishing milk for invalids, or for infants, ought, as regards these milch animals, to be submitted to a constant control confided to veterinarians officially designated for this purpose.

In recommending these resolutions for the adoption of congress it has been felt that they are fully called for in view of the danger which has long threatened the interests of stock owners and the health of the community, and which constitutes a veritable calamity.

Lydtin begins by tracing the history of tuberculosis, showing how like other diseases, and notably glanders, it appears in forms that are

not recognized as identical with the common types, and how, in consequence, its true characters, its prevalence, and, above all, its contagious property were ignored, until anatomo-pathological observations showed the identity of the lesions in different organs, and biological experiments established the true nature of the disease germ.

He thinks Moses refers to phthisis in the word *dürre*—(leanness) Lev. xxii, 22—and Columella, as phthisis (*De re Rustica*); the same idea is embraced in most of its common designations—as pining, consumption—decline, *Schwinden*, *Schwindsucht*, phthisis, *ulceration pulmonaire*, *Lungen verschwörung*, *lungensucht*, *lungenfäule* sufficiently illustrate.

Another form has been named and classified, on account of sexual aberrations, *nymphomania*, *satyriasis*, *Stiersucht*, *geilesucht*, *Monatsreiterei* (German), *ninfomania*, *furore uterino* (Italian), *Brummel* (Swiss), *bulling* (English).

Another form has been named, from the more or less firm excrescences which appear on the serous membranes and skin—*Perlsucht*, *Hirse-sucht*, *Meerlinsigkeit*, *Züpfigkeit*, *Kranichkeit*, *Rindshammen*, *Traubenkrankheit*, pearl disease, knots, kernels, grapes, angleberries, clyers.

The supposed syphilitic character of the disease produced the following names: *Franzosenkrankheit*, *Francausoricitost pri Krawach*, *Last-seuche*, *Unreinigkeit*, *cenerie et morbus gallicus boum*.

The implication of the glands and the sarcomatous and fibrous character of the growth has given rise to still other names: *Drüsenkrankheit*, *malattia glandulare*, *sarkomdyskrasie*, *euhexia boum sarcomatosa*, *sarcomatosis infectiosa*, *sarco-tuberculosis*, *tuberculosis fibromatosa*, *rindstuberculose*, &c. Again, as it appears in the pig in the form of scrofula, it has been called *scrofula tuberele*.

No wonder that the identity of all those forms of the disease was slow to be recognized, and that pathological anatomy and inoculative experiments had to be invoked to determine it. The name to be preferred is the generic one *tuberculosis* (or *tuberculosis panzootica contagiosa*), and yet this must not be held to imply that the nodosity (tubercle) is a constant and pathognomonic feature of the disease.

The manifestations of the disease are entered on fully, showing that after the preliminary slight fever (marked symptoms often subside and of the local lesions are confined to certain non-vital organs) there may be comparatively little sign of illness for months or years. The flow of milk may be abundant, and though variable yet of no fixed quality, and the animal may breed, work, or even fatten without suspicion. As the diseased processes extend over the system febrile symptoms reappear and tend to assume a remittent character, the temperature becoming abnormally low in the morning and high toward night, and at the same time wasting advances more or less rapidly. Enlargement of the cervical lymphatic glands, irregular appetite, tympanies, colics, constipations, and diarrheas, and indications of lesions of the respiratory organs, are especially common. In certain cases there may be muscu-

lar or nervous disorder, cramps, paralysis, wryneck, epilepsy, turning in a circle, coma, blindness, in others disease of the testicles, or udder, of the bones, joints, and skin.

The affection may prove fatal in less than three months, or it may last for an ordinary lifetime. It may induce other diseases of the organs in which it is located, and thus greatly complicate the symptoms or hasten a fatal result.

It follows that the disease is not always easy to diagnose. Yet its symptomatology is quite as advanced as that of many other diseases, and with the recent demonstration of its germ—*bacillus tuberculosis*—it is sufficient for the purposes of veterinary sanitary police.

The pathological anatomy of tuberculosis is more perfect. The lesions most constantly met in the cadaver are the neoplasms on the pleuræ and peritoneum. These vary in size from a millet seed to a pea; they are single or united in bunches (grapes), pedunculated, polypoid, or warty, red, flesh-colored or brownish yellow, and of most varied consistency. Very often the center of the soft nodosity is deep red, while that of the hard one is yellowish and caseated or of the consistency of mortar. According to Virchow they appear first as little nodosities or pearls in groups projecting slightly from the surface of the serous membranes; later they become pedunculated, remaining connected by vascular bands of connective tissue; still later earthy salts are deposited in them, and finally they soften, undergoing fatty degeneration, and become like a thick mortar.

Changes in the lymphatic glands of the head, neck, chest, abdomen, &c., are also present in all but the most exceptional cases. These are swollen, and of a dull, yellowish color, impregnated with juice or pigmented. They show hæmorrhages as large as a pin's head, irregular enlargements, and indurations. On section the surface shows numerous infiltrated points of the size of a millet seed to a pea, of a grayish yellow or whitish color, and the consistency of cheese or mortar. Larger centers of irregular shape, but the same characters, are also met with.

The lungs in most cases present similar lesions in nodules and nodosities in all stages from the simple hemorrhagic point to the caseous or calcareous mass, also connective tissue neoplasm, which obliterate the pulmonary lobules and attain considerable size, and finally caseous masses in the midst of lung tissue, otherwise unaltered. Sometimes the nodosities of the pleura covering the ribs adhere to those on the lungs, and they may become continuous into the lung tissue for an indefinite distance.

The softened nodosities may open into the pleural sac with fatal effect, or into the bronchia, causing a grumous discharge from the nose and mouth, and when empty they form cavities—*vomicæ*.

The nodules are common on the mucous membranes of the trachea, larynx, pharynx, and gullet, and in the submucous tissue of these parts, and softening and discharging they form funnel-shaped ulcers, which

become confluent and cause deep and extensive sores invading the sub-jacent cartilage and other tissues.

Sometimes the brain and spinal cord are invaded, but especially the pia mater and arachnoid, giving rise to the most varied nervous symptoms, and passing through the same changes with an especial tendency to puriform softening when in the brain substance.

Tubercular deposits in the coats of the bowels are found in cattle in the form of nodules varying in size from a pin's head to a hempseed on the inner surface of the peritoneum (Niklas), and in pigs in the forms known as scrofula or caseous enterites.

The miliary nodules and aggregations of them are also found in the liver and spleen, less frequently in kidneys and bladder, and in the generative organs (tunica vaginalis, cord, testicle, uterus, ovaries, Fallopian tubes, vagina), and in the mammary glands. The muscles are occasionally the seat of tubercle, and the bones rather frequently so. The neoplasm takes place by preference in the cancellated tissue of the extremities of long bones, and in that of the bones of the cranium, and the spines of the dorsal vertebræ.

The relative frequency of the more common seats may be deduced from the following table of 1,596 cases observed in Baden :

	Per cent.
Lesions of the lungs only.....	21
Lesions of peritoneum and pleura only.....	28
Lesions pulmonary and pleural	39
Lesions of generalized tuberculosis.....	9
Lesions of generative organs only.....	3

Microscopically the tubercular products are composed of—

(a.) Excessive growth of new connective tissue which, in the lungs, may amount to 55 to 100 pounds.

(b.) Connective tissue growths interspersed with centers of degeneration: *first*, hemorrhagic points; *second*, small vitreous looking masses, and, *third*, soft caseous collections. Both these forms show a strong propensity to calcification, and in bones to genuine ossification.

(c.) Sarcomatous neoplasms or tubercular nodosities. These have a vascular stroma of connective tissue inclosing masses of round lymphoid and fusiform cells. The peripheral cells have a clear outline, and there are few free nuclei, while in the center the cells become opaque and indistinct with little protoplasm and shriveled nuclei and free nuclei and granules abound. These also are often calcareous.

(d.) Tubercles varying in size from a millet seed to a hen's egg. These appear in the parenchymatous tissue of the lung, &c., while those formerly described affect rather the surface and the serous membranes. These are at first small and translucent, but increase by juxtaposition and confluence, and being exclusively cellular become early calcified, or more frequently caseated. These are much more numerous in an infected tissue than any product likely to be mistaken for them.

(e.) Ulcers of various forms and dimensions. In all these lesions

there is the same initial change—proliferation of the connective tissue. The variations in the nature of the lesions depend on the different activity of the intercellular substance and the connective tissue and endothelial cells, on the disaggregation of the elements and the occurrence of ulceration. Thus the fibrous growth is usually greatest where connective tissue is most abundant, as in bones, cartilages, and interlobular lung tissues, while the more cellular and rapidly disintegrating growth occurs in connection with epithelial structures, as in the air cells and on the inner coat of blood-vessels. This tendency to attack the connective tissue and lymphatics, and to show products varying according to the nature of the surrounding structures is common to other infectious diseases, and notably glanders, chronic lung plague, actinomykosis, &c. As in these cases, too, the morbid process is first localised and only becomes diffused when it has attained a certain local intensity. Again, it agrees with other infectious diseases in being favored by certain unhygienic conditions, as damp pastures, close filthy buildings, overcrowding, poor food, excessive work or milking, &c., yet is not absolutely dependent on any one or more of these, nor due to these alone. As in these other affections there is the disease germ—*bacillus tuberculosis*—the presence of which is essential to the development of the disease, and its recognition completes the diagnosis.

Again, there is a special constitutional predisposition in animals having an excess of connective tissue and of lymphatic development as in cattle and swine.

Climate seems to have much effect, as the disease is virtually unknown in northern and arctic climates—Iceland, Northern Norway, and Sweden, Finland and Lapland—and very common in the temperate and tropical regions.

(While frost doubtless chains up this germ when out of the body, as it does others, it must not be forgotten that the paucity of cattle in the extreme north will even more tend to retard the propagation of this disease. Other countries formerly free from tuberculosis have now, by the influx of consumptive patients, and, in some instances, by the greater density of the population, become extensively affected with this disease, as witness the Hebrides, Australia, and our northwestern States and Territories.—J. L.)

To the same effect speaks the great prevalence of tuberculosis in dairies near cities where the stock is often changed and new stock is being constantly purchased, and its almost complete absence from districts exclusively devoted to breeding and never importing strange stock. This is but a repetition of what is known of other contagious diseases. Wild races, too, living in the open air are largely exempt.

Heredity as a cause of tuberculosis.—In favor of the heredity of tuberculosis Lydtin quotes from over a score of veterinary authors. The congenital presence of the disease is proved by quotations from König, Stirnimann, Adam, Butscher, Virchow, Semmer, Jessen, Fischer, Mil-

ler, Zipplius, &c. The infrequent recognition of the disease in veal calves is noteworthy, being generally only a fraction of 1 per cent., but it must be added that tuberculosis in the dam, affecting the fetus, usually determines the death of the latter, followed by abortion, and that of those in which the disease stops short of this the tubercles often rest circumscribed and inactive in an unimportant organ until the young animal is more fully developed, or even grown up.

(I have repeatedly seen abortions as the first indication of tuberculosis in a herd, and calves of healthy breeds infected by milk grow to maturity and then fall victims, where the ancient calcified products were found side by side with the recent. It is further to be noted that the calves more severely affected perish of indigestions, diarrheas, &c., and are buried by the owners without any notification of the authorities. These, therefore, cannot be fattened for veal.—J. L.)

Göring noticed that in bovine tuberculosis 123 were infected by the dam and 43 by the sire. The hereditary cases constituted 12 per cent. of all cases of the disease. All veterinary and agricultural writers attribute a most disastrous influence to *in-and-in breeding* (in infected families).

The special predisposition of animals with much loose connective tissue has been already referred to. It is further noticeable that this is a prerequisite to aptitude to fatten, and it is notorious that many families of our best breeds of meat-producing animals are affected with tuberculosis, while the disease is less prevalent among unimproved races.

(In this connection we must not ignore the *close breeding* of the latter, their residence in a hot forcing atmosphere, and their preservation for breeding purposes, even when manifestly unhealthy, nor the free open-air life and the prompt disposal of unthrifty beasts among the less valuable breeds. The disease being due to a specific germ, it should be limited by the repression of that and not by abolishing in our meat-producing animals those qualities which constitute their value.—J. L.)

The conclusions as regards heredity are thus:

1. That heredity is not without influence upon the propagation of tuberculosis.
2. That this malady is transmitted alike by the sire and the dam.
3. That the transmission of the morbid principle to the ovule or fetus in course of development, is a cause of sterility in the parents, and frequently occasions abortions and premature parturitions.
4. That a fetus affected with tuberculosis rarely attains complete maturity or comes into the world in conditions of normal viability.
5. That notwithstanding these facts, we cannot deny the possible birth (perhaps in great numbers) of tuberculous descendants which can develop and multiply equal to animals, in perfect health and without any predisposition.

Contagion as a cause of tuberculosis.—Lydtin refers to the above proof of the transmission of the disease through the ovum, sperm, uterine secretions, &c., and proceeds to offer further evidence of direct contagion. He quotes Ruhling, Krunitz, Fromage, Huzard, Spinola, Crugel,

Lafosse, Villemin, Dupont, and Zaugg, in support of this, and advances the following proposition :

The morbid principle can enter the system either by the respiratory or digestive apparatus. The inspired air and the forages and drinks can act as vehicles; it may also be transplanted by way of the generative organs (coitus), or by wounds, accidental or experimental.

Instances of infection by cohabitation are quoted from Stahl (to 4 stud bulls by a newly-bought tuberculous one of different blood); Renner (to cow and calf from tuberculous cow of different blood); Fischer (heifer from tuberculous cow and 3 cows and ox from tuberculous cow of alien blood); and Jaum (11 cows from a new tuberculous one); Ross (4 cows from a new tuberculous one); and others by Visen, Zundel, Grad, Haushatter, Leutz, Huzard, Tessier, D'Arboval, Remy, and Hugues. Cases of infection through *food* are quoted from Jessen (calves sucking sick cows, died in six to twelve months); Volkens, Lehnert (2 pigs of healthy parents in one month after feeding unboiled milk of sick cows); Bromley, Walley, Fleming, Zippilius (calf sucking tuberculous dam died of diarrhea with circular, belt-like ulcers of small intestine); Gerlach (many calves and pigs infected by milk of sick cows), &c.

Transmission by *coition* is less definite, but is inferred from the occurrence of tuberculosis in the womb, Fallopian tubes, and ovary of the female (Adam), and the testicles of the male (Schlotterer), also from the abortions in tuberculous herds.

Of *transmission by raw surfaces*, all the cases of experimental inoculation are instances. Lydtin took lymph from lung affected with tubercle and lung-plague, but carefully avoided any point where tubercle could be detected, and avoided also the blood as far as possible. With this he inoculated 10 cattle, 5 of which, when killed twenty-three days later, showed numerous distinct miliary tubercles in the inoculative swelling, and one tubercle in the right lung; the remaining four showed tubercles of older date in the lungs.

Toussaint inoculated a tuberculous cow with cow-pox, furnished by a healthy heifer, and eight days later from the resulting cow-pox vesicles inoculated four rabbits and a pig. All of the rabbits became tuberculous in two months. -

In the field of the experimental transmission of tubercle, the work has now been extensive and the results most convincing. Villemin, Gerlach, Chauveau, Colin, Soujon and Court Paul, Günther and Harms, Rivolta and Peroncito, Bagge, Bollinger, Kolne, Semmer, Biffi and Verga, Bouley, Peuch, Aufrecht, Toussaint, and others have contributed in varying degrees to the solution of the question, and the grand result attests indubitably the communicability of the disease.

Günther and Harms conveyed the disease to 5 rabbits by making them *breathe* the expired air from tuberculous cows. Tappeiner conveyed it to dogs by diffusing the tuberculous sputa of man in spray in the air they breathed.

Experiments in feeding the infecting matter are tabulated as follows by Johne.

Animals experimented on.	Number of animals.	Results.		
		Affirmative.	Negative.	Doubtful.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Horses	1	0.0	100.0	0.0
Calves	5	100.0	0.0	0.0
Sheep	35	51.4	12.9	3.7
Goats	13	84.6	15.4	0.0
Swine	60	65.0	18.3	16.6
Rabbits	171	31.2	66.5	2.3
Dogs	20	25.0	75.0	0.0
Cats	9	55.5	44.4	0.0
Guinea pigs	6	83.3	16.6	0.0
Pigeons	2	0.0	100.0	0.0
	322	43.5	51.1	5.0

Table giving the results in the same animals according to the food eaten.

Material fed.	Results.		
	Affirmative.	Negative.	Doubtful.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
117 tubercular matter from heifer	61.5	34.2	4.3
46 raw flesh of tuberculous cows	13.1	86.9	0.0
91 milk of tuberculous cows	30.7	59.3	1.0
1 milk of tuberculous rabbit	100.0	0.0	0.0
25 tubercular matter of man	36.0	64.0	0.0
33 tubercular matter of pig	53.0	47.0	0.0
2 tubercular matter of sheep	100.0	0.0	0.0
2 tubercular matter of rabbit	50.0	50.0	0.0
3 tubercular matter of ape	100.0	0.0	0.0
5 tubercular matter of birds	100.0	0.0	0.0

Johne concludes—

1. That tuberculosis can be transmitted from animal to animal and from man to animal by feeding on tuberculous substances, but this mode of transmission is much less certain than by inoculation.

2. The materials which most certainly transmit tuberculosis by gastrointestinal ingestion are tuberculous matter taken from the lungs, pleuræ, and lymphatic glands; milk of tuberculous animals, as regards its contagious properties, must be placed near to these. Infection by tuberculous matter taken from man is less certain than by that taken from animals.

3. Infection is less certain from the ingestion of muscle than by the substances indicated under 2, and yet it occurred in seventy-six cases in the above named experiments.

4. Calves, sheep, goats, and swine present the greatest susceptibility to tubercular contagion; the pretended immunity of carnivora is not so pronounced as certain authors have alleged.

Gerlach found that of 46 animals fed raw tuberculous matter 35 became infected; that of 35 fed raw muscle from tuberculous subjects 8 became infected, and that of 15 fed cooked tubercular matter 10 were infected.

Bollinger produced tuberculosis in pigs by prolonged feeding of the milk of tuberculous cows.

The subcutaneous inoculations of Villemin and his successors were hotly disputed on the ground that they gave rise to lesions analogous to those produced by inoculation with non-tubercular matter. These were practically settled by the intraocular injection of white rabbits with tubercular matter by Cohnheim, Salomonsen, Hansell, Deutschmann, and Baumgarten. After an incubation of twenty to thirty days there appeared in the pigmentless eye distinct tubercular nodules, and this was followed by a generalized tuberculous. Baumgarten developed tuberculosis in the eye by injecting the blood of tuberculous animal infected by inoculation. In test experiments with the blood of healthy animals the eyes remained sound; when he used the blood of septicæmic patients intense inflammation of the eye ensued, but never tuberculous.

Toussaint found the tubercular lung products of cows constantly infecting to rabbits and pigs after they had been subjected to 55° to 58° C. in a water bath, and even after they had been roasted like a beef-steak in the gas flame. He found the nasal discharges, the saliva, and the urine infecting, and as already noticed the lymph of a vaccine vesicle. Lydin concludes :

That tuberculosis is contagious, like glanders or lung plague, and that contagion fills a more important rôle than heredity in the propagation of the disease.

As showing the identity of tuberculous in man and animals, Koch's demonstration of the bacillus tuberculosis must occupy a prominent place. The disease had already been proved a hereditary and an infectious one, and this organism, found in the growing tubercle of man and animal alike, suggests itself at once as the morbid germ. It is found alone and unmingled with any micrococcus, in deep seated tubercles, which have had no exposure to the air, while in sputa, vomica, and other tubercular products exposed to the air a multiplicity of other organisms abound. In all cases of rapidly growing tubercles the bacillus is present in great numbers, while in those of slow formation they are scanty. These bacilli have a length of half the diameter of a red blood globule and a breadth of one-fifth of their length; they are motionless and form spores within the body even during the life of the animal.

After many attempts Koch succeeded in procuring a pure culture in blood serum of cow or sheep in a preparation of gelatine, on which the bacillus appears as fine scales at the end of two weeks. They grow so slowly that it is only at the end of the third or fourth week that the mass attains the size of a poppy seed. It does not develop save at a temperature of 30° to 41° C. These peculiarities of culture identify the parasite.

The bacillus, whether derived from the tubercle of man or that of animals, always shows the same form and the same habits during culture, and on inoculation has produced the same pathological lesions, implying the essential identity of the two.

By numerous carefully controlled experiments Koch has proved that it is impossible to produce the typical alterations of miliary tuberculosis by the inoculation of other matters than the bacilli; in these experiments he has taken all necessary precautions to avoid confusion with spontaneous tuberculosis, and to exclude all infection from any accidental source of the subjects on which he operated. He concludes that the presence of the bacillus in the tuberculous masses is not a simple concomitant of the tuberculous process, but the cause, and that we must recognize in the bacilli the cause of tuberculosis, hitherto unsuspected, but now evident in the form of a vegetable parasite.

Koch has found this parasite in all forms of scrofula and tubercle in man and animals, and in 109 inoculated subjects (rabbits, guinea pigs, and cats) in the nodosities of the lungs.

Add to this that Villemin and Klebs have demonstrated that the tubercle of man, on inoculation, produces phthisis pulmonalis in animals, and that this inoculated phthisis is transmissible by inoculation to other animals.

Johne mentions a case of successful inoculation of tubercle from man to man, and Staag a case of the accidental infection of the son of healthy parents by habitual drinking of the warm milk of a tuberculous cow.

Another argument in favor of the identity of the disease in man and animals is the perfect analogy of the disease as regards heredity and contagion in the two.

The heredity in man is shown by the presence of the disease in the fetal off-spring of tuberculous parents. Walshe records the frequency of abortion and sterility in tuberculous patients. The doctrine of the contagion of tuberculosis in man has been sustained by Galen, Norton, Swieten, Home, Maret, and many later observers. Instances are quoted of infection through clothes and beds, and from husband to wife. Wichmann, in 1780, said that one death in six in the population of Zurich was from tuberculosis, and details the different channels of direct and indirect contagion, going so far as to advocate a supervision of the sale of old bedding and clothing. Cullen, at the same date, speaks of its propagating itself most readily in the warm climates of Southern Europe, where (Italy, Portugal) to the present day the clothing, bedding, and other agents used about a person deceased of phthisis are invariably destroyed. Lydtin concludes:

1. That tuberculosis has been observed in all warm-blooded animals submitted to domestication or deprived of their liberty.

2. Tuberculosis of animals and of man present analogous manifestations in the living and in the cadaver.

3. The course and termination of the two maladies are the same in man and animals.

4. The tubercular masses, and, above all, the expectoration of phthisical men determines tuberculosis in animals when these masses are introduced into the latter by the respiratory or digestive apparatus, or by a deep wound. Tuberculosis inoculated from man to animals can be thenceforward transmitted from one animal to another, producing in all cases tuberculosis.

5. Tuberculosis in man and in animals is transmitted by heredity.

6. Tuberculosis is contagious to man as it is to animals.

7. There are clinical observations proving the transmission of tuberculosis from animals to man through the use of the milk of phthisical animals.

8. Tuberculosis of man and that of animals are rare in the cold climates, and even appear not to be developed. They are more frequent in warm climates; the geographical distribution of the two maladies is almost the same.

9. It is demonstrated that a pathogenic microbe having the same morphological and biological characters, exists in the tubercle of man and in that of animals. This organism, whether developed in man or animals, can produce tuberculosis when, cultivated in a state of purity, it is transmitted to a susceptible animal.

It is only necessary to add that tuberculosis in animals tends to concentration in the large dairies and feeding establishments which supply the great centers of population. The farmer, watching closely the animals he has owned since their birth, is led, by the instinct of self protection, to sell off those that show symptoms of failing, and these usually go to the large establishments near the cities, there to be crowded in close buildings with many others, to which they in turn convey the infection. If in a dairy, these supply milk for the population at large, including the susceptible infants and invalids, and finally all or nearly all of such animals find their way to the butcher's stall, when they can no longer be utilized for other purposes.

(To show that America is no better than Europe in this respect, it may be stated that 29 per cent. of the adult males dying in New York City are tuberculous, and that in certain of the herds that supply that city with milk, 20, 30, and even 50 per cent. are affected with the same disease. In some country districts of New York can be shown large herds with 90 per cent. the subjects of tuberculosis. Were all the known facts published concerning the ratio of tuberculosis in certain communities and in the herds supplying their meat and milk, there would be a testimony far more telling than even the striking example of New York City. One stands appalled at the immensity of this evil, covering as it does the entire country, threatening at every step the health of the community, and crying loudly for redress.)—J. L.

Nothing has as yet been said as to the propagation of tuberculosis from man to animals. In the large stables adjoining cities the feeding of products from the kitchens, mixed with excretions of man, doubtless contributes to this, and the contrast of the frequency of tuberculosis among these and its absence among the wild oxen of Hungary suggests the importance of such a factor.

PREVENTIVE MEASURES CALCULATED TO CHECK THE EVIL RESULTING FROM THE CONSUMPTION OF THE MILK AND FLESH OF TUBERCULOUS ANIMALS.

Lydtin refers to the law of Moses, under which the pining (*dürre Schwinden*) animal could not be eaten; to the *Mischna*, which expressly condemns carcasses the lungs of which cannot be inflated, or have attached growths; to the continuation of this law among Christians until the third century; to the Roman masters of markets (*ædiles*), who saw

that bad and corrupt meat was thrown into the Tiber; to the church law published in the tenth century against the consumption of diseased meat; to the ancient laws of Italy, France, Spain, and Germany against the sale of diseased meat, and to the more modern statutes on the same subject. He quotes from Züickert (1775) the case of the death of twelve students from eating the flesh of cows of which the viscera were covered with a great number of vesicles, tubercular nodules, and purulent tumors. In furnishing such meat for the soldiers a French butcher was, in 1716, condemned to nine years' exile, a fine of £5,000, and permanent prohibition from engaging again in the same trade.

A German law of 1732 imposed a penalty of 50 rix thalers, with the addition, in certain cases, of corporal punishment for the sale of such meat or for evading its inspection. About 1764 the doctrine of the identity of tuberculosis and syphilis was contested by Zink, Rühling, Heim, Graumann, and Zwierlein, and the German law was abrogated while that of Lower Austria was modified so as to condemn only advanced cases. In Southern Germany, Austria, and Switzerland the meat of tuberculous animals has always been more or less forbidden. In the main, however, it is only advanced cases, those with profound and extensive lesions, that have been condemned. The same has been the case for France and Belgium. France was the first, in 1810, to abolish private slaughter-houses in large and medium sized cities, and to introduce that essential condition of all effective inspection—municipal abattoirs. Later this has been adopted by nearly all the cities of Europe and a thorough inspection rendered possible.

Cooking of diseased meat in general was held by Payen, Renault, and others to render it innocuous. Its value as regards tubercular products was first investigated by Gerlach, who also led in the inquiry as to the danger from the different portions of a tubercular system. He found that the morbid matter resided mainly in the tubercle, from which it spread slowly along the lymphatics to the next lymphatic gland, and then still along the same vessels to more distant glands, and finally it became generally distributed. He further attached much importance to the multiplicity of caseous centers, especially in the lungs, as the breaking down of the nodosities as well as the extension and increase in numbers of the tubercles imply a greater danger of the contamination of the flesh. Emaciation is another indication of the general action of the poison. A very advanced condition of any one of these morbid states should forbid the use of the flesh as food.

The Veterinary Council of Germany (1875) and the Berlin Veterinary School (1878) respectively pronounced on the subject with great reserve, virtually holding the matter still *sub judice*. Johnes held that the mere extension of tuberculosis from the first seat to the neighboring lymphatic glands did not imply unwholesomeness in the flesh, and that it was only requisite in such cases to cut out the tubercles, enlarged or diseased glands and adjacent connective tissue. He pronounced the flesh

as dangerous when the extended lesions implied an infection of the blood; when, for example, from primary deposits elsewhere there are resulting tubercles in lungs or pleuræ. Zundel, basing his opinion on the failure of Koch to find the bacillus in any part save in the tubercular centers, concludes that no meat should be condemned except that furnished by animals emaciated and thoroughly infected.

That measures protective of the public health should be taken is indisputable. The demands of those who demanded new experiments have now been realized. The experiments demanded have been repeated, and when practiced with all needful precautions have given positive results. The bacillus of tuberculosis has been isolated, cultivated, and transmitted by inoculation, and whatever the soil from which it has been transplanted (man, animals, gelatine preparations, &c.), it has always determined the development of true tuberculosis in the inoculated animals, and this tuberculosis has proved transmissible from one inoculated animal to another. Tuberculous meat is certainly infecting. How, then, can we protect the community against its effects? One says: *by thorough cooking*; another, *by confiscating the diseased meat*.

While the *boiling temperature* is destructive of the tuberculous bacillus we cannot rely on meat being heated to this temperature. In North and Middle Germany people continue to eat raw meat, notwithstanding the frequent outbreaks of tuberculosis. Again, in ordinary cooking the center of the meat often remains below 212° F., the color of the blood indeed frequently persists. The proposal to sell this meat only in separate stalls at a low price, so that the purchasers would be warned to cook it thoroughly, would be ineffectual, as it would not change the general habit of cooking, and above all it would furnish no safeguard against its careless preparation in public institutions and elsewhere where it is used on a large scale.

Confiscation, applied to all cases, would be far more effectual, and with competent inspectors this could be carried out; but in practice it is surrounded by numerous difficulties. Diagnosis is easy, and with a single municipal abattoir all cases should be detected, but it is found that all the infected do not come to such abattoirs. In Baden 20 per cent. of these are killed elsewhere. An attempt to apply the law stringently in Mannheim resulted in an organized effort to thwart the officers of justice. Stock owners refused to sell to the city butchers unless relieved of all responsibility as to the soundness of the animals, and the butchers declined to use the city abattoir and insisted on handling only dead meat which had been killed outside. The opposition even extended to the consumers, on whom the price had been raised, and the vigorous measures were finally abandoned.

If the difficulty is met by inspection of herds a considerable expense will be incurred and other objections invoked. In short, a sound public spirit is essential to the maintenance of any really effective work.

Another difficulty arises from the degree of infection. If all tubercu-

lous carcasses are seized the way is plain, but if a selection must be made disputes will constantly arise over the interminable shades of difference in the various subjects. The delicacy of the question to be pronounced upon in these cases would demand for each commune a veterinarian exclusively devoted to the work of inspection, but this would add considerably to the expense incurred.

Turning to milk, it cannot be denied that boiling would give the required guarantee of safety; but in the *milk-cure* establishments and where this liquid is produced for infants, it is sought fresh and used without boiling, and yet these places seek for the heaviest milkers, and often secure tuberculous cows. For these, and indeed for all dairies, there should be a State control of the milch animals and their products.

In the present state of public opinion it may be impossible to apply measures that will be really effective in preventing the sale and use of tuberculous meat and milk, yet, where already applied, the preventive measures have proved so beneficial that we must advocate their maintenance and extension. It is encouraging to know that public opinion is gaining on this matter, so that ere long more effective measures will be sustained.

The present difficulty resides in the inevitable imperfection of any control of meat and milk by themselves, and that any permanent surveillance of the cattle without the concurrence of the owners will furnish no guarantee commensurate with the gravity of the danger.

The difficulties of the case will be largely met if the State *will deal with tuberculosis in animals as with other contagious diseases*. The owner, well accustomed to the effects of the disease and practiced in weeding out the consumption and sending them to market, can be called upon to report all cases to the authority. The veterinarian can easily diagnose the disease, or in the few uncertain cases can decide positively at the autopsy. He can further, as in the case of glanders, maintain a prolonged surveillance over the inmates of that stable, and above all on those related by proximity or by blood to the animal slaughtered. Thorough disinfection of stables, utensils, clothing of attendants, &c., can be carried out. If the great majority of a herd are infected, the apparently sound may be taken to another building. The diseased and suspected may be slaughtered at once or after a few weeks' fattening. The sale of the milk and flesh of all tuberculous animals should be forbidden. Finally the owner can be indemnified for every beast confiscated. This alone will secure the co-operation of the owner, without which all efforts will be very partial and imperfect.

In view of the insidious progress of the disease it is desirable even to furnish an indemnity for the carcass of an animal found to be diseased after slaughter. This will do more to check the clandestine sale of tuberculous meat than the most rigid administrative control of the abattoir and butcher's stall.

This indemnity will remove all injurious pressure from the veterinary

inspector, and enable him to decide with a safe margin what meat and milk can be sent to market without injury to human health.

The indemnity may be a tax on the State, on the commune, or on the stock owners and butchers who will eventually profit most by the suppression of the disease.

ACTION OF THE CONGRESS.

On account of the short time available for the consideration of the question, Wehenkel opposed any action at the present congress, but Quivogne, Larmet, Aune, Rossignol, and Bouley urged a decision of the question, "*In what cases can the meat be used for food?*" This was agreed to.

Lydtin furnished a resume of his report and concluded by presenting paragraph *f* of his resolution for the acceptance of congress.

Bouley held that one of the most difficult questions in practice was what an inspector should do with the carcass of a tuberculous beast. It is established that tuberculosis is a malady dangerous to the animals which are able to contract it, not only by the respiratory passages, but also by ingestion into the stomach and by inoculation in any part of the system. He referred to Toussaint's experiments of which the results were frightful. The tuberculous element did not reside only in the tuberculous lesions, but is diffused through all the tissues. The juice of the flesh of a tuberculous animal, even after it had been heated to 50° or 60° Cent., that is the temperature of roasting beef, has proved virulent for the ox, pig, cat, rabbit, &c., even when given only in a virulent dose, a small dose; large doses are not necessary. Considering the facts in this light we ought to establish no degrees in tuberculosis; when it exists it renders the consumption of the flesh dangerous. He is convinced that tuberculosis, whatever may be its degree, should entail the condemnation of the meat; it can only be utilized if well cooked.

Tuberculosis of man is certainly contagious, as is known to all the world, being principally transmitted from husband to wife. The disease is very widely spread, affecting one-fifth of our population. We must look to butcher meat as one of the principal causes of this great prevalence of tuberculosis; it is probable that the infection enters by the digestive passages as in the experiments of the laboratory. He concluded by proposing the following amendment:

Tuberculosis being experimentally demonstrated as a malady transmissible by the digestive canal and by inoculation—

The congress declares that meat provided by tuberculous animals should be excluded from the food of man, whatever may be the stage of the tuberculosis, or the apparent qualities of the meat.

In his judgment, stock owners should be indemnified, and butchers urged to establish mutual insurance societies.

Van Hertsen detailed the practice in the Brussels abattoirs, long in

use, and which he had set forth in a paper laureated by the Veterinary Society of Eure and Seine in 1869. He seizes all lean tuberculous animals, all having numerous and generalized tubercles, or with tubercles softened, caseous or purulent, lesions which create the suspicion of general infection of the system. When their lesions are grave and multiple, whatever may be the quality of the meat, seizure is always ordered; when the tubercles are localized and recent, and provided the carcass is sufficiently fat to guarantee good meat, it is allowed to be used. As to the danger from unboiled milk he had with Degive, in 1868, presented a paper to the Belgian Academy of Medicine on the frequency of tubercle in the mammæ of cows, but the academy discarded the subject without discussing the important question of hygiene therein presented to them.

Wirz proposed an amendment of *f* in Lydtin's report, that in place of "to a very small part of the body, when the lymphatic glands are still free," &c., read "to but a small part of the thoracic or abdominal viscera, when the lymphatic glands which do not belong to these are free," &c.

Van Hertsen believes that tuberculosis can invade the lymphatic system when the disease is yet in its earliest stage. He has observed that the gland situated between the first and second rib is tuberculous eight times out of ten. This gland is of the greatest importance in determining the quality of the meat, as it establishes the fact of tuberculosis without the necessity of examining the viscera. It serves to distinguish tuberculosis from lung plague in carcasses from which the pleuræ has been removed, *the chest skinned*, as the butchers say. (This gland has been called the motive (*motif*) gland of the inspector.)

Lydtin advocated his proposition as more practicable under present circumstances than Bouley's; while Bouley called for the *advocacy* of thorough measures, their *administration* was the concern of the authorities.

After further amendments of Rossignol and Van Hertsen, paragraph *f* of Lydtin was adopted, several members declining to vote.

Rossignol proposed to amend paragraph *g* by omitting the last sentence, permitting the use of the milk after boiling, and as thus amended it was adopted.

Bouley requested a vote on paragraph *h*, offering the following modification :

It is proper to furnish an indemnity for cattle in good condition found to be tuberculous after slaughter.

Rossignol supported an indemnity for animals in good condition, but only when killed for human food.

Ærts, Wehenkel, and Lydtin opposed on the ground that this was only a question of goods of bad quality, the use of which for a purpose to which it is unfitted is forbidden. An indemnity should only be given when an owner must give up his chance of the recovery of a sick animal in the interest of the public good.

As a prolonged discussion was threatened and time pressed, Müller

proposed the closure of the question which had already exceeded that proposed for the *order of the day*, namely, *the utilization of the flesh*. The discussion was accordingly closed.

A paper was handed in signed by eleven members explaining that they had declined to vote on tuberculosis on the ground of lack of time to sufficiently discuss such an important subject.

After providing for the next international veterinary congress to be held in Paris, the meeting adjourned.

REMARKS.

(The importance of the question of the sale of meat and milk from tuberculous animals cannot well be overrated. But to control the former we need a complete reformation of our system of slaughter in the large cities and villages. One municipal abattoir should be established in each great center of population where alone stock should be slaughtered for food and where the carcass and viscera of every animal slaughtered would be examined by a competent veterinary inspector. All establishments for the killing of meat to be shipped fresh to the cities, to be salted or canned, should be placed under similar supervision. Meat from uncontrolled slaughter-houses should be excluded. So far as we know no American city has adopted the system of municipal abattoir and complete veterinary inspection, and the great majority have neither. The expense would be considerable, though only a trifle as compared with that caused by the sicknesses, incapacity, and death now occurring from a disease which affects one-fifth and upward of the population in the great cities. We say nothing of the other contagious diseases from which this measure would protect the people. With regard to the milk supply there should be frequent visitation of the dairies supplying the large cities, the maintenance of a census of the animals, and an inspection by a competent veterinarian of all cadavers of animals killed or dying by natural cause. Not only would this protect the human population against infection through the milk, but it would overcome the present great difficulty in dealing with the lung plague, which would thus be traced to every center of infection and could easily be stamped out. The question of the suppression of this disease over the entire national domain is by no means such an easy one; the task is so gigantic and the outlay would be so vast. In many herds in the Eastern States the proportion of tuberculous animals ranges from 10 to 30 per cent., and in the West with freer range it is doubtless far less frequent, yet if we were to estimate but one infected animal in thirty it would embrace over a million cattle and one and a half million hogs. Indemnities alone for this number would amount to from \$30,000,000 to \$40,000,000, to say nothing of all contingent expenses. That it would pay in the single item of the preservation of our live stock there can be no doubt, while its effect on the health of the population would be beyond all estimate. To the professional man, fully acquainted with the enormity of the evil,

it is hard to wait for the slow growth of public opinion while infancy and manhood are being cut down indiscriminately by a preventable contagion, and while even he himself must continually run the gauntlet of the deadly blow of the insatiate enemy. Every instinct of sanitation, of justice, of humanity, of self-preservation, and of morality rebels against the indifference of the people, but more particularly of the statesmen. But it is with tuberculosis for animals in general as with lung plague for cattle in particular, or with glanders for solipeds and man, the retribution for neglect is not executed with that promptitude which strikes terror to the mind; the laity fail to connect the final desolation with the distant cause, and the most deadly of all contagia is permitted to hold on its darksome way unchecked.

A single case of cholera, yellow fever, or even of small-pox in a large city is considered good cause for excited editorials in the newspapers and for extraordinary efforts on the part of boards of health, while every day from January to December scores are perishing unnecessarily from the more insidious and far more deadly tuberculosis.

The control of this affection cannot be advocated as either cheap or easy, or likely to be crowned by an early extinction of the disease as would be the case with lung plague. It will entail an immense organization, large expenditure, and persistent application, not only until all our flocks and herds are purified, but until the present tuberculous generation of men have given place to a healthier, and until by a slow improvement, generation by generation, the population shall have finally risen above this bane of our civilization. It is, however, a work that may be profitably undertaken by installments, first in the abattoirs and dairies of our large cities and suburbs, then in our markets for live stock, and our great emporia for butcher meat, then in all our large public institutions, and finally in our flocks and herds at large. It may safely be predicted for the city that will take the first effectual step in this direction that the showing made by her vital statistics will soon attest the wisdom of the course. The results will be no less beneficial to the stock owner, for apart from the protection of his own health and the assurance furnished him that he is providing a wholesome food for the people, his herds will be saved from a contagion which now causes incalculable losses over the entire country.

Upon our statesmen the burden of all this responsibility rests. They are intrusted with the expenditure of the nation's money, and with this trust they become severally responsible for every evil which it is in their power to ward off. To wait for the irresistible pressure of public opinion in a matter such as this, which appeals so strongly to their humanity, their religion, their patriotism, and self-preservation, is unworthy of the high place they hold and the charge which the people have confided to them. They have been chosen to do the work of legislation for which the people at large have no time; it is their duty to consider these matters when laid before them and to act on them, and on them must rest

all the blame of the deaths and disasters that result from their apathy and neglect.)—J. L.

RESOLUTIONS ADOPTED.

First question.—Veterinary service.

1. To organize in each country a veterinary service, exclusively charged with all that pertains to this service, of which the members, all veterinarians, should be counselors of every department of the Government, but which should be more especially represented in close relation to the central power; that veterinary medicine should there have her chief of service.

2. The veterinary sanitary service should utilize the greatest possible number of veterinarians. It embraces the surveillance of fairs and markets of animals; the inspection of butcher meat and abattoirs; the control of rendering works; the inspection of breeding animals; the surveillance or direction of mutual assurance against the mortality of stock; the revision of the census lists of domestic animals, &c.; it comprehends the service of the state, and may be made international, embracing especially the repression and suppression of contagious and epizootic affections, also the control of the various other veterinary services.

3. Between the various states which, by a regular repressive and preventive service against epizootics, can furnish guarantees of a good veterinary sanitary police, there should be established a treaty having for its object—

(a) To apprise the other states as speedily as possible of any outbreak of rinderpest, pleuro-pneumonia, aphthous fever, sheep-pox, *maladie du coit*, glanders (or farcy), or of scab in sheep.

(b) To publish periodically a sanitary bulletin upon these maladies, their extent, progress, and extinction, which particulars should also be published in the international bulletin if judged necessary.

(c) To oppose these maladies by measures of sanitary police, which have first been discussed and adopted as the most desirable.

(d) To furnish with animals and herds, moved into or out of any territory, certificates of origin and health of a value guaranteed by the administration.

(e) To contribute to the publication of an international veterinary sanitary bulletin.

Second question.—Pleuro-pneumonia.—Lung plague.

A.—DIFFERENTIAL DIAGNOSIS.

1. From an anatomical point of view, at least in its relation to veterinary police, one may consider as epizootic contagious pleuro-pneumonia; every pneumonia which is lobular and at the same time inter-

lobular, and the development of which does not depend on traumatic causes.

2. From a physiological standpoint in the living animal, epizootic contagious pleuro-pneumonia is specially characterized by its contagious character and by the symptoms of lobular pneumonia.

3. In an infected place every animal which shows febrile reaction or symptoms of disease of the chest should be considered as suspected of pleuro-pneumonia. Every animal found in an infected stable or which has been in one within three months antecedent, or which has been able to be contaminated in any other way, should be considered as suspected of contamination.

B.—PROPHYLAXIS.

1. Recognizing that from the point of view of sanitary police epizootic pleuro-pneumonia is a disease which propagates itself only by contagion, and is usually incurable and fatal, the congress declared that to prevent the development and propagation of this malady there should be applied the measures against contagious diseases that are at the same time fatal and incurable.

2. Animals diseased or suspected of the disease should be sacrificed as quickly as possible.

3. Contaminated animals or those very much exposed to the contagion should be isolated or sacrificed. The slaughter of contaminated animals is especially indicated when the disease manifests itself very exceptionally, or for the first time in a stable belonging to a commune or country rich in cattle.

4. We have to-day experimental proof that it is possible to invest the organism of animals of the horned species with an immunity from contagious pleuro-pneumonia by inoculation with the virus of this malady.

5. Preventive inoculation, that is to say, that which is practiced when the malady does not prevail in a country, ought to be absolutely rejected. Inoculation, so called, of necessity, that is to say, that which is practiced when the disease exists in a herd, may be permitted but not made obligatory.

6. The inoculation should always be done by a veterinarian.

7. It is not proved that an inoculated animal cannot transmit the disease to a sound animal.

8. Inoculated animals should be reported to the authorities.

9. Quarantined animals should be made the object of a special census, and should receive a distinctive brand with a hot iron.

10. No animal suspected of infection should be moved without previous authorization of the communal administration. The permit to move should only be granted for animals destined to the butchery; it should only take place in special conditions under the supervision of the police, and in such a manner as to prevent all propagation of the malady.

11. Every bovine animal offered for sale ought to be accompanied by a certificate of health testifying that no epizootic has existed for at least six weeks in the commune from which it came.

12. In certain special cases, to be determined by the official veterinarian, there may be prescribed the suspension of fairs and markets, the prohibition of the importation of animals from a suspected country, quarantine, the posting of notices at the entrance of infected circles or farms, and the issue of handbills and instructions warning the people of their obligations, and of the precautions to be taken to prevent the appearance or extension of the malady.

13. An active supervision should be exercised, not only over the quarantined animals, but also, *a*, over animals exposed for sale in markets, fields, and fairs; *b*, over animals lodged temporarily in the stables of inns adjoining the markets; *c*, in stables containing many animals, subject to frequent changes, and when the malady has already made one or more outbreaks.

14. The duration of quarantine should be six months at least, apart from the last case of the malady.

15. At the release from quarantine the animals should receive a second mark to annul the effect of the first.

16. The flesh of an animal slaughtered should not be used for food, unless authorized by the veterinarian making the autopsy.

17. The skin should not be utilized until it has been steeped for twenty-four hours in an approved disinfectant solution.

18. Carcasses and cadaveric *débris*, unfit for food, should be buried, or so treated as to be absolutely inoffensive.

19. Stables, fair grounds, markets, and vehicles which have been occupied by diseased or suspected animals, should be carefully cleansed, disinfected, and purified. These different operations should be under the direction of a veterinarian.

20. A stable should not be refilled with animals until it has been entirely evacuated and thoroughly disinfected, and then purified by eight days of free ventilation.

21. Pastures that have been occupied by diseased animals ought to be quarantined for at least fifteen days.

22. The different materials, objects, and instruments that have been employed in the slaughter, transportation, or burial of diseased or suspected animals, should be destroyed, or thoroughly disinfected. Forage and litter should be utilized for horses or other solipeds.

23. Persons who have become soiled by infecting materials, should wash their hands, wash or brush their clothes, and wash their boots with a disinfectant solution.

24. All persons and animals capable of carrying the virus should as far as possible be kept from diseased animals, their carcasses and cadaveric *débris*.

25. It is proper to grant an indemnity to owners for animals slaugh-

tered by official order and for the cost of disinfection. The indemnity should amount to four-fifths of the value of the animal, and to the full value, deduction being made of the value of portions of the carcass that can be utilized if the animal should prove healthy.

26. Very heavy penalties should be imposed on persons who violate the different sanitary regulations decreed by the authorities.

27. A good organization of the veterinary service is the best guarantee of the application of the different measures prescribed.

28. A last and potent measure for securing the extinction of contagious pleuro-pneumonia would be the adoption of means for the contagious diseases of animals similar to that in use for the phyloxera of the vine; to formulate an international agreement in which shall be indicated the essential elements that ought to form the basis of legislation to be adopted by each country which shall join to carry it out.

Third question—Veterinary education.

1. To be admitted to veterinary studies one must be bachelor es-lettres or es-sciences; that is to say, he must have finished the studies of the secondary education.

2. There is no call to create veterinarians of different classes having a different amount of preparatory or veterinary education.

3. Four years of study at least are requisite to make a full study of veterinary medicine, if that is made to include physics and natural sciences.

(a) The instruction of the two first years (four first semesters) should embrace the following branches: physics, chemistry, natural history (zoology, mineralogy, botany, and geology), anatomy, histology, physiology, and shoeing. A course of practice and demonstrations in micrography should always be included.

(b) Clinical teaching should continue through the whole of the last two years of study. That the practical instruction of the student may be complete it is absolutely necessary to have, beside a stationary and consulting clinic (hospital clinic and polyclinic), an ambulatory clinic (outside clinic); there ought to be at least two professors of clinics.

(c) The inspection of butcher-meat is an absolutely essential branch of veterinary education.

4. At the end of each year veterinary students should be examined on the studies which they have been taught that year. No one should be allowed to follow the course of the advanced year unless he has passed this examination.

No one should be admitted to examination for the degree of veterinarian who has not followed a course of clinical instruction for two years after having passed the examination of the second year of study.

The board of examiners for granting degrees should always be formed partly of professors and partly of practitioners.

5. Internal (board under military rule) and external (residence outside) are optional in veterinary schools.

6. Veterinary schools may be independent establishments, or they may be connected with universities or institutions for the higher education, but veterinary medicine should have its special chairs. One cannot but disapprove of institutions in which all branches of veterinary education are divided in a very limited number of veterinary chairs; such a system is absolutely insufficient.

It is very desirable that in every country veterinary schools should be state institutions.

7. The professors of veterinary schools ought to possess diplomas of veterinary medicine. It is very desirable that veterinarians before being called to the professorship should have practiced veterinary medicine for some years.

Fourth question.

(See body of report.)

Fifth question—Tuberculosis.

The flesh and viscera of a tuberculous animal can only be utilized for human food when the disease is found in the cadaver in the incipient stage, when the lesions are confined to a very small portion of the body, when the lymphatic glands are still free from all morbid tubercular lesions, when the tuberculous formations have not yet undergone softening, when the flesh presents the characters of meat of the first quality, and when the animal is in good state of nutrition at the time of slaughter.

It should not be permitted to remove the flesh of tuberculous animals admitted to consumption out of the locality where they have been slaughtered, and it should not be offered for sale in the butchers' stall.

Every quarter of meat and all viscera showing lesions of tuberculosis, as well as the flesh of any other animal in which there is found at the necropsy a tuberculous infection more pronounced than that referred to above, should be watered with petroleum oil, and afterward buried under police supervision. The extraction of fat by cooking and the utilization of the skin may be permitted.

The inspection of every animal attacked by tuberculosis should be made by a veterinarian, who alone should decide if the flesh is fit for human consumption.

The milk of animals affected with tuberculosis or suspected of it should not be taken by man nor by certain animals. The sale of this milk should be severely interdicted.

Respectfully submitted.

JAMES LAW.

Hon. GEORGE B. LORING,
Commissioner of Agriculture.

HAMBURG INTERNATIONAL EXHIBITION.

REPORT OF J. H. SANDERS.

Hon. GEO. B. LORING,
Commissioner of Agriculture.

SIR: On the 19th day of May, 1883, I had the honor to receive an appointment from you with the following instructions:

You are hereby appointed and commissioned an agent of the United States Department of Agriculture to attend the International Exhibition at Hamburg in 1883, and you are instructed to examine and report upon the following special points:

The character of the Exhibition in all its departments of live stock as compared with our own.

The general condition and supply of live stock in England and on the Continent.

The breeds most met with and that seem to be most desirable and popular; also, their relative merits as compared with our own.

The probability of improvement to our own stock by further importations, and the breeds most desirable for this purpose, if any.

The dangers from contagious diseases that may be apprehended from continued importations, if any.

The methods of live stock husbandry practised compared with our own.

The probable future demand from European countries for American live stock and meats.

The present hindrances and restrictions that affect the exportation of live stock from the United States, and how they may be modified or removed, especially with reference to the exportation of our live cattle to Great Britain, and our hog products to Germany.

In pursuance of the foregoing instructions, I started upon my mission May 26, landing at Liverpool. After a brief sojourn in that city, devoted mainly to an examination of its cart-horses, I proceeded to London, where I spent several days familiarizing myself with the markets, the modes of travel, and other matters of importance connected with the live-stock industries of that city. As one of the principal objective points of my visit was the International Live Stock Show at Hamburg, I determined to go at once to the continent, leaving England and Scotland for my return trip. Accordingly, June 19, I left London purposing to make my journey to Hamburg via Paris, stopping *en route* to make a study of

THE DRAFT HORSES OF FRANCE.

The constantly increasing popularity of the French draft horses in this country, as evinced by the large numbers annually imported, and the

interest I myself had taken in some of the discussions growing out of the business, led me to attach a good deal of importance to what I might learn concerning them by a careful personal investigation of some of the controverted points. Among the most important of these were the following :

1st. Are there any well-established distinct breeds of draft-horses in France? 2d. What guarantees, if any, can American importers obtain in France that the horses purchased by them belong to any particular race or breed, and that they are purely bred? And 3d. To what breed do the horses usually brought to America from France belong, and in what part of France are they bred?

It may not be out of place for me to remark here that during the past six years I have, myself, been compelled to participate in several controversies, through the agricultural and live-stock papers of the country, touching the draft horses of France and the name by which they should be known in the United States. Throughout these controversies I relied mainly upon such of the printed history of these horses as had been translated into English, and upon what I could gather from intelligent gentlemen who had personally given more or less attention to the subject in France. It was therefore with a good deal of pleasure and interest that I embraced the opportunity afforded me, by my present visit, to go into this question thoroughly for myself. And first let me say that many American importers, especially the earlier ones, and some even at the present day, go to Paris, buy their horses of a dealer who has gathered them up from various quarters, and then return without the slightest knowledge of the breeding of their horses, or of the region where they are bred. It is not to be wondered at, therefore, that such men can tell nothing of the breeding of these horses when they get home, because they know nothing, beyond the fact that they had bought them of a French dealer at Paris, Dieppe, or Havre. If they attempted to say anything beyond this, they simply drew on their imagination for their so-called facts. After awhile, however, those with some experience in the business, and with some knowledge of good horses, began to inquire into the subject, to try to find out where the *good* horses came from, so that they might get them, if possible, from first hands. I began my investigations in the same way. I went first to the sales stables of Paris, fortified with all the knowledge I had been able previously to obtain upon the subject. I went first to M. Vidal, who is a noted horse dealer of Paris, and who has undoubtedly sold more stallions to American importers than all the other horse dealers of Paris combined. In reply to my question, he said: "Fully 90 per cent. of the horses that I buy to sell to Americans, for stallions, come from beyond Chartres, in the Perche; the others are picked up here and there, wherever we can find one good enough for the market; but we sell them all as *Percherons*." The other dealers all told substantially the same story.

After spending a few days in Paris, talking with horsemen and gathering what information I could, I determined to see the Percheron breeding district for myself. All authorities agreed in pointing out Nogent le Rotrou, situated about 100 miles southwest from Paris, in the ancient province of La Perche, as the heart of the Percheron breeding country. It is at and near this place that Mr. Dunham has bought hundreds of horses within the past three years for the American trade, and where the Messrs. Dillon and several of the other importers have made most of their purchases for some time past; and in this region is the only place where any attempt is made to maintain the Percheron race in its purity.

On the day of my arrival at Nogent le Rotrou, a large number of Percheron breeders had met to consult upon the propriety of establishing a Percheron stud-book, in order to preserve the purity of the race and to protect themselves from unscrupulous dealers in Paris and elsewhere. I was much interested in the discussion which took place. The gentlemen present represented the principal breeders for some 20 or 30 miles around, and I was told that they owned at least 100 stallions that had been kept for service this season. I questioned many of them. Among others, the statement of Mr. Ernst Perriot, one of the most noted of the breeders present, is a fair sample of what all had to say. He is a very intelligent gentleman, and has sold many horses to American buyers. I should judge him to be about fifty years of age. His statement was in substance as follows:

I have been breeding horses right here all my life, and my father and grandfather were in the same business before me. We never breed or sell any other than pure Percherons. We have usually kept 6 or 7 stallions each year for service. They travel around the country, serving mares owned by the farmers at about 25 francs each. We keep an eye on these mares, know where the best ones are, and when the foals are weaned we buy many of the best ones each year and keep them until we can sell them at a fair profit. I am sure there has been nothing but recognized pure Percheron stallions used in our stud since the time of my grandfather, and nothing else has been used in this whole Percheron region within my knowledge. There is a tradition that about the time my grandfather engaged in the business some Boullonnais blood was introduced into this country for the purpose of increasing the size of the Percherons, but certainly there has been none since about fifty years ago. The true Percherons will now average as large or larger than the Boullonnais. Neither Mr. Dunham, Mr. Dillon, nor any other American importer has ever bought any Norman horses here. We don't have any such horses. You can see plenty of Normans in Paris; they are all small horses, mostly bays, and are used in the cabs and carriages. They are generally half-bloods got by English thoroughbred sires, and some of them are out of Percheron dams, and are usually called Anglo-Normans.

The same statements, substantially, in regard to purity of race and the name, were obtained from all the breeders interviewed, notably Auguste Tacheau (province of Sarthe), Pierre Sagot (province of Eure-et-Loir), and Celestin Caget (province of Orne). In fact, so far as I could learn, it was almost an insult to ask one of the breeders present if they bred or sold any other than Percheron horses, and they spurned the term "Norman" with contempt.

These are the men of whom all the leading American importers have been buying for several years past. They buy these horses as Percherons, from men who will call them nothing else, and yet a few of them come home and abuse everybody who refuses to call them Normans. There is not much in a name, but sometimes a name contains a deal of meaning within itself.

It was an agreeable surprise to me to learn that so much pains had been taken by these Percheron breeders to preserve the purity of the race. It had been asserted that nobody knew anything about it; that the Percherons were mongrels, and that no man could give the pedigree of his horse. I found, on the contrary, that, while they have not paid much attention to preserving the maternal genealogy, many of the sires can easily be traced six or eight generations. One young horse, now owned by Mr. Ernst Perriot, is a noteworthy example. This horse is a three-year old, and is so highly valued by his owner that he has absolutely refused to name a price on him. Fifteen thousand francs were offered for him by an American buyer in my hearing; but the owner shook his head and said, "You might safely double it." This young horse was got by the black horse Brilliant (No. 1271 of the Percheron-Norman Stud Book), that now stands at the head of Mr. Dunham's stud, at Wayne, Ill., and the line of sires back of him is known for seven generations. Mr. Perriot proposes to raise the service fee of this horse to 100 francs next season, a price that has hitherto been unheard of in the Percheron breeding district. As another instance of the care which French breeders are taking to secure good breeding stock for themselves I may mention the fact that Mr. Auguste Tacheau recently paid 3,000 francs for a suckling colt, which he designs to use in the stud.

You will doubtless remember that one of the things discussed between us at our interview a few days prior to my departure upon this mission was the desirability of a Percheron stud-book in France in order to protect American breeders from imposition, and to afford some guarantee of the purity of the blood of the horses brought to this country from France. And you will also no doubt remember that the desirability of such a publication was made the subject of a special communication from you to the French minister of agriculture, at that time. It is therefore with no small degree of satisfaction that I am able to report that the Percheron breeders of France have fully resolved on a stud-book. The meeting to which I have heretofore alluded, as having occurred on the day of my arrival at Nogent le Rotrou, was simply informal and preliminary, but on Saturday, June 23, a largely attended meeting was held at the same place, about one hundred breeders, representing the provinces of Eure-et-Loir, Orne, Sarthe, and the whole of the ancient province of La Perche, being present. At this meeting a permanent organization was effected under the sanction of the Government, with M. Fardonet as president, and Messrs. Vinault, Perriot de Champeau, Sagot Anatote Miard, Poullain, Lucas, Launay, Aveline, Tacheau, and

Caget as vice-presidents; M. Boullay-Chaumard, secretary-treasurer. These, with the mayor of the city of Nogent le Rotrou, the prefect of the department of Eure-et-Loir, and the prefect of Nogent le Rotrou, constitute the "board of direction" of the Société Hippique Percheronne. The rules for registration are very strict, and every application must be sworn to, giving the genealogy as far as it can be traced, and establishing beyond controversy that the animal is "born Percheronne." Penalties are provided to prevent fraudulent entries or disreputable transactions generally. In short, it looks like a strong, resolute, aggressive organization from the start, and will mark an era in the Percheron breeding business.

I conclude, from a considerable sojourn in France, that Americans who buy directly from the breeders and "stallioners" (stallion keepers) of the Percheron district have heretofore had a reasonably certain guarantee of purity of blood, and henceforth the assurance will be as complete as can be obtained with any breed of draft horses in the world. Those who buy of the dealers in Paris and in the cities on the coast can have no such assurance, and their own eyes must judge of the breeding. It is to be hoped that hereafter no imported horses will be admitted to registry in the Percheron-Norman stud-book of America that are not previously registered in the Percheron Stud-Book of France. It would have been infinitely better for the reputation of the breed, and for our own horse stock, if such a regulation had been practicable and enforced years ago.

There are many most excellent horses working in the drays, trucks, and omnibuses of Paris. The omnibus horses will average much larger than has been represented by most writers. They are usually thin in flesh, and the weights, when given at all, have been with reference to that condition. I stood on the street one day for an hour in company with two experienced importers, watching these horses, especially with a view to estimating the average size. The verdict was: average weight in good flesh—fat as stallions are usually kept in America—between 1,400 and 1,500 pounds. These omnibuses are enormous, great double-deckers, holding about sixty-five persons, and are drawn by three horses harnessed abreast. Fully seventy-five per cent. of these horses are white, and they nearly all have the usual Percheron characteristics. M. Vidal, the Parisian horse dealer previously alluded to, told me that he sold about 1,100 horses a year for use in the omnibuses; that nearly all of them came from beyond Chartres in the Perche, and that the average weight was about 1,400 pounds. The horses one sees in the drays are larger; an average lot of imported Percheron horses is but little if any better or larger than the average cart-horse as seen in the streets of Paris. They are massive, strong, patient fellows, and are nearly all Percherons.

In no city that I have visited are the horses driven so hard and treated so unmercifully as in Paris. The drivers whip their horses and rush

about like madmen, and although the streets are very wide and rarely crowded, yet the pedestrian who attempts to cross must keep a sharp lookout or he will be run over. The cab-horses of this city are a sorry, rough looking lot, which I attribute mainly to their bad usage. The drivers of the cart-horses do not seem to be quite so unmerciful, but throughout all Paris the prevalent idea with a driver seems to be, that a horse was made to *use* and to *abuse*. Even in the Percheron breeding districts I noticed traces of this same feeling, and here also I noticed the most striking lack of a knowledge of the value of cleanliness in the management of a horse. The French are miserable groomers; their horses are filthy and dirty, and are left mainly to take care of themselves, so far as cleanliness is concerned.

THE HAMBURG INTERNATIONAL EXPOSITION.

From Paris I went direct to Hamburg to visit the exposition, or "International Show," as it was called, which opened July 2. It was in many respects a disappointment. In some features it was equal to an ordinary Ohio, Illinois, or Iowa State Fair, but in many others it was far behind the usual annual exhibit in those states. In the single feature of dairy stock it was great; and I never had so high an appreciation of the quality of the Dutch-Friesian or Holstein cattle as since seeing them at this show. It is, however, so far as I can learn, the best exhibition of the kind ever held on the continent, the number of entries largely exceeding those of the Paris Exposition of 1878.

The "classes" were legion. There were 56 classes for horses and mules, with 424 entries; 141 classes for cattle, with 902 entries; 88 classes for sheep, with 728 entries; and 50 classes for pigs, with 277 entries—certainly classes enough and entries enough to make a grand show. But, unfortunately, many of the entry numbers were blank, a condition of things which seems inseparable from the system of numbering and cataloguing an exhibition of this nature in advance of the opening.

The various breeds of live stock of Germany and of Northern Europe generally were well represented, with the exception of those of Russia, from which country I was not able to find anything. In this I was disappointed, as I had hoped to see a good representation of the famous Orloff trotting horses. The show of draft-horses was scarcely worth mentioning. There were a few creditable specimens of the English cart-horse, and some draft-horses from Belgium, but none worthy of especial notice. The government breeding studs, of Germany, were pretty well represented with horses of the thoroughbred type; very fair specimens, but in no wise remarkable. In short, the horse-exhibit generally impressed me as a heterogeneous mass of no especial excellence in any particular. There were some dun ponies, from Norway, about 14 1-2 hands high, very heavily built, and blocky—enormous draft horses in miniature, that were much admired. There were no French horses on

exhibition. In fact no stock from France, so far as I could learn, except French merino sheep.

The feature of the cattle show was the dairy stock, and in this I never saw anything that could approach it. Hundreds of the Friesian or Holstein cows were there, with their grand udders, and every indication of milk-producing capacity of the highest order. I could not help remarking to some American friends who were with me that I feared our importers had not yet taken across the waters any of the *best* of the race, for I certainly never saw such dairy cows in any show-yard in America as I saw at Hamburg. I am now more than ever convinced that, all things considered, the Dutch cow is the general dairy cow, *par excellence*, of the world.

I was also very much interested in the Oldenburg cattle, a race that in color closely resembles the Holstein or Friesian breed; rather darker in color, not quite so good, I should say, for the dairy, but very much better for beef. In fact, the very best beef cattle on exhibition, in my opinion, were these same Oldenburgers. They are smooth, rather fine in bone, handle fairly well, and bear every indication of good feeding quality. If it were possible to combine the beef-making quality of the Oldenburg cattle with the great milking capacity of the Dutch cows it would come very near making the model cow for the average farmer.

Another class of cattle that interested me much was the Angeler, a race that seems to be peculiar to Schleswig-Holstein; little fellows rather smaller than the average Jersey; very dark red, bordering on brown in color, very fine in the bone, and evidently deep and very rich milkers. Mr. H. Chandos-Pole-Gell, one of the delegates from the Royal Agricultural Society of England, remarked to me that to him this class was the most interesting one in the show; but while I freely concede to them great milking and butter capacity in proportion to size, I could not help thinking of "Uncle Billy Smith's" *bon mot*, anent the Jerseys, at the Illinois State Fair two years ago: "They will do for a man who is too poor to keep a cow and who is ashamed to keep a goat." They are *too little* to be of much practical use, but they are evidently a very pure race, and good machines for making milk and cream, in proportion to their size.

There were some short-horns on exhibition, but they were, with the possible exception of one or two cows, miserable specimens of the breed. There were also a few Ayrshires, and one or two Polled-Angus, of very ordinary merit. The Swiss cattle were out in considerable force, and, from their uniform gray color and the immense bells that accompanied them, attracted a good deal of attention. They were of fair size, pretty good on the back, many of them, but coarse and bad handlers, evidently lacking in what cattle breeders usually denominate "quality."

As a matter of curiosity I was interested in the little cows from Norway. They are little things, much smaller than the Angeler cows above alluded to, with remarkably thin, flat bodies, on very short legs,

white on back and belly, the sides a light yellow, streaked with black, marking them much like a tiger. About a dozen of them were in the show.

The show of sheep was not remarkable in any feature. The French merinos rather took the lead in numbers, closely followed by the English mutton breeds, the various classes of Downs, with a few Cotswolds and Lincolns. Of the French merinos, there were many most excellent specimens, better and larger than any I had heretofore seen. The people of Germany appear to be "taking to" the Southdowns, Shropshires, Hampshires, and Oxfords largely.

In the swine department of the show I was pleased to see our American-Poland Chinas holding a prominent place, and, in my judgment, the very best specimens of swine on exhibition were of this breed and imported from America. Mr. John C. Funch, of Oldenburg, was the enterprising gentleman who made this exhibit, and his swine are certainly most creditable representatives of the breed. In point of numbers, the white breeds, mostly of the various Yorkshire families, made up about 60 per cent. of the show, while the remainder were about equally divided between the Berkshires and Poland-Chinas, with a few Essex.

I may sum up my impressions of this show by saying that, while it was very creditable in most departments and great in display of dairy stock, I saw nothing worthy of especial remark in the management. The system of classification was very complete, and the several breeds were usually grouped together in their stalls or pens so that one desiring to examine any class of stock found but little difficulty in doing so. The published catalogue of the exhibits was also a great convenience to visitors, as in it full particulars as to name, age, pedigree, ownership, etc., were given. The custom of issuing a catalogue of this sort is general with European agricultural shows, and might be followed in our own country with profit.

I saw no breeds of live stock at this show the importation of which to the United States, in my judgment, should be encouraged or recommended other than the Holstein or Friesian-Dutch dairy cattle and the Oldenburgs, to which I have alluded in the foregoing. They are certainly most excellent breeds of cattle for the purposes indicated. The former have already been extensively introduced in our country, and are certainly rapidly growing in public favor. To what extent the Oldenburgs might be profitably imported, if at all, I am not prepared to say. I can only reiterate my former statement, that they were certainly the best beef animals on exhibition, and that they also seem to possess an adaptation to the uses of the general dairy farmer, but little inferior to the Holsteins or Friesians, which they closely resemble.

OUR PORK IN GERMANY.

While in Germany I made diligent inquiry in order to ascertain so far as possible the feeling of the Government and people concerning the

admission of American pork to that country. Among the trades people in the cities, so far as I could learn, the feeling is very strong against the prohibitory policy of the Government, but among the best informed people, and those connected with the Government, the case is just about as follows:

The swine of both Germany and the United States are confessedly, to some extent, infected with trichina. The German authorities require that the flesh of all swine slaughtered in that country shall be subjected to a microscopic examination by a Government inspector, and pronounced free from trichina, before it can be offered for sale. No such examination is practicable with salted and packed meats from America, and as no pretense of an inspection of our meats is made by us under Government authority, or even under the supervision of the packing firms, the German Government says, "We cannot accord to American packers and butchers a privilege which we refuse to accord to our own." So far as I could gather, it is generally conceded that whenever an inspection of our pork is made, under careful governmental supervision, similar to that now made by the German authorities, there will be no objection to its sale in that country. Indeed it strikes me that were such an inspection made there would be such a strong pressure brought to bear upon the German Government by their own people that the embargo would be speedily removed. The presence or absence of this microscopic parasite in the pork of this country is a matter of but little interest to us, as Americans *cook* their pork before eating it, and thorough cooking obviates all danger, but in Germany, where much of it is eaten raw, it becomes a serious matter. Should further experiments confirm what has been already partially shown, that thorough curing in salt destroys the vitality of the trichina, if not entirely, at least, to so great a degree as to reduce the danger from meats that have been thoroughly cured by this process to almost nothing, it will doubtless be a strong point in our favor, and a proper presentation of the facts to the German Government, should this be clearly proven, ought at once to be made. Until this fact is clearly established, however, and in the absence of any pretence of inspection of American meats, either under governmental or individual supervision, the position of the German Government is obviously sound upon this question, and cannot be assailed without first demonstrating that their own inspection is useless.

OUR EXPORT CATTLE TRADE WITH GREAT BRITAIN.

From all that I could learn while in England, the trade in dead meat between the United States and Great Britain is not at all satisfactory either to those engaged in the trade or to the consumer. The facilities for securing the exact temperature necessary in order to maintain the proper condition of the meat during the ocean voyage are so imperfect that the meat not unfrequently reaches the consumer in a more or less damaged condition, and large losses have resulted. All well-informed

persons agree that the most satisfactory results will be attained when we shall once more be able to show a clean bill of health, and send our live cattle, under such regulations as will insure their health and comfort, to the farms and pastures of England and Scotland, there to be slaughtered when their condition and the state of the market requires it.

It ought not to be considered strange that British farmers should make strenuous efforts to still further restrict or totally suppress the importation of live stock for slaughter in their country. They have suffered enormous losses in times past from imported disease, and during the last few years they have been contending with great obstacles, not the least of which has been the great supply of agricultural products that America has sent to that country. Under these circumstances it is not to be expected that British farmers will be inclined to take a strictly judicial view of the case. Naturally they would like to secure a better market for their own stock, and equally naturally they magnify possible danger of importing disease from this country. On the other hand, it should be borne in mind that the English Government has steadily refused to yield to the demands for further restrictions, and has in the main done full justice to American interests, especially in the recent alarm over the reported existence of foot-and-mouth disease in this country.

It is doubtless true that British farmers do not regard the existing condition of the meat trade with this country favorably, and that whenever they are satisfied that it may be done with safety they would much prefer that the restriction should be removed altogether, rather than that the present arrangement of compulsory slaughter be continued. As the trade is now conducted the supply received from the United States detracts just so much from the demand for home products, and the British farmer has no opportunity for even an incidental share in the profits of the business. On the other hand, could our cattle be safely admitted without restrictions, immense numbers of store or partially fattened cattle would be shipped to that country, and would be taken inland to British pastures and finished up on British food, thus enabling British farmers to reap profits out of the better fitting of these cattle for the market, and also to utilize them in the converting of the provender of the farm into manure, a very important consideration with the farmers of that country. During my visit to that country I conversed with many farmers upon this subject, and I never met with a single man who expressed himself as otherwise than favorably disposed towards the free admission of American cattle whenever it could be done with a reasonable guarantee of safety from contagious diseases; and in nearly every case the hope was expressed that the time would soon come when the present restrictions might safely be removed. Instead of being opposed from motives of self-interest to the free introduction of our cattle to that country, the feeling seems to be general among English farmers, so far as I heard any expression of

opinion, that the profit derived from the "finishing up" process would more than compensate for the resulting competition.

Feeling certain that this is the view generally held by intelligent and progressive British farmers, and also strong in the belief that we shall at no very distant day be in such a condition as to enable us to give our British cousins assurances concerning the sanitary condition of our cattle that will be satisfactory, I confidently look to the entire removal of the present restrictions as a thing reasonably certain to occur in the near future. Of course this belief and hope is based upon the confidence I feel in the course which our General Government, aided by that of the infected States, will take in respect to the stamping out of contagious diseases and in otherwise improving the sanitary condition of our cattle, and also in the surveillance which, in my opinion, will at no distant day be exercised over our exports.

The importation of cattle from foreign countries was a fruitful theme for discussion in Great Britain during the time I was in that country. The unusual extent to which foot-and-mouth disease has prevailed there during the past year and the losses resulting therefrom to British farmers have made them extremely restive, and while the Government has been active in its efforts to stamp out the disease, it has been constantly importuned to adopt still more stringent regulations to prevent the introduction of contagious diseases from abroad. All Americans interested in the subject are aware that for several years past a regulation has been enforced which requires that all cattle brought to Great Britain from the United States must be slaughtered at the docks where landed within ten days after their arrival, no matter what may be their condition or the state of the market. This edict of compulsory slaughter is based upon the assumption that to admit the free transit of cattle from the United States to the farms and pastures of Great Britain would expose the cattle of British farmers to increased dangers of infection from pleuro-pneumonia or lung plague, the presence of which disease along a portion of our Atlantic seaboard is admitted.

In the mean time Canadian cattle have been freely admitted without compulsory slaughter or detention, no contagious diseases having been found among the cattle of that country, and the Canadian Government maintaining a rigid quarantine against the cattle of all foreign countries, the United States included, and also making a careful inspection of all exported cattle and exercising a rigid supervision over the ships in which they are carried. In consequence of these regulations a Canadian bullock will bring \$15 to \$25 more at the Liverpool or London landings than could be obtained for the same bullock if exported from the United States. To some European countries where the sanitary condition of the cattle is not so satisfactory as in the United States even the grace of compulsory slaughter is not accorded, but the landing of live cattle therefrom is absolutely prohibited.

In January last a shipment of cattle was received at Liverpool from

Boston, which, upon inspection, was found to be suffering from foot-and-mouth disease. In March a shipment was received from Baltimore in the same condition. The publication of these facts led to a strong popular demand upon the Government that absolute prohibition should be applied to all cattle from the United States; and in July, while I was in London, Mr. Chaplin introduced a motion in the House of Commons which was, to all intents and purposes, a demand upon the Government that such action should be immediately taken. In spite of the opposition of the Government party, Mr. Chaplin's motion prevailed by a majority of eight.

I listened with a good deal of interest to the discussion which this motion elicited, and, in common with all other Americans who took any interest whatever in the subject, I regarded the vote by which it was carried as a very threatening omen. Indeed, the agent of the Dominion Government of Canada said to me the day after this vote was taken that he was certain that within a week an order would be issued absolutely prohibiting the landing of American cattle at British ports. I set at once actively to do what I could to counteract this. The pretext set up for this action was the presence of foot-and-mouth disease in the United States. My position as an accredited representative of our Department of Agriculture, and my opportunities for ascertaining the facts as a member of the Treasury Cattle Commission, enabled me to make representations touching the actual condition of our cattle that attracted attention, and which I believe were quite generally accepted as true. Through the London Times and by personal interviews with members of Parliament and with the chief veterinary adviser of the privy council, aided, I may say, by the efforts of others, I was able not only to counteract the effect of the vote on Mr. Chaplin's motion, but to bring about a much more satisfactory state of feeling, so far as the security of the present condition of the trade is concerned, than had previously existed.

I was able to explicitly deny the existence of foot-and-mouth disease in the United States, except in cases of direct importations from Great Britain, which cases had been promptly detected and closely quarantined, and to state positively that the cases of foot-and-mouth disease alleged to have been brought from the United States were due solely to the infected ships which had brought diseased cattle to our own ports, and without proper disinfection had been loaded with fat cattle for Liverpool.

The effect produced by this plain statement of facts was so considerable that Mr. Arnold called attention in the House of Commons to the assurances contained in my letter in the Times of July 18th, and also to one of a subsequent date from General Carman, of the Department of Agriculture at Washington, and asked the Government: "Whether, in view of these facts, the present restrictions might not safely be removed so far as cattle from the Western States were concerned."

The answer from the Government was, as I supposed it would be, to the effect that, under the existing act of Parliament, no concession could be made in favor of a portion of any country that could not be accorded to it as a whole, I succeeded in obtaining from Professor Brown, the chief veterinary adviser of the privy council, an admission that in his opinion a plan might be devised by which cattle from our Western States might now be admitted with reasonable safety. This I regarded as a very important admission; but the nearness of the end of the session of Parliament made it useless then to ask for such additional legislation as would be necessary in order to enable the privy council to carry out this idea. I may add, in this connection, that Professor Brown, speaking for the privy council, expressed himself as greatly pleased with the steps which the Agricultural and the Treasury Departments of the United States had taken within the past year or two to improve the sanitary condition of our live stock and to prevent the importation and spread of contagious diseases; and that the impression is rapidly gaining ground that we shall soon be in such a condition that cattle from all parts of the United States may be admitted and taken inland without any danger from disease. This feeling is based mainly upon the steps which our Government has already taken, and a faith that we shall continue to go forward in the same direction.

I cannot but regard it as extremely fortunate that some one who could speak with some degree of assurance, and whose opportunities, from knowing the facts, were acknowledged, should have been on the spot in London in July last to correct the misapprehensions that existed touching the prevalence of foot-and-mouth disease in this country; and I think it reasonably safe to predict that, with the enforcement of such regulations as are now contemplated by our Treasury Department, and with such additional legislation as may be reasonably expected from our Congress at its next session, the time is not far distant when American cattle will be placed upon an equal footing with those from Canada so far as admission to British ports is concerned.

IMPRESSIONS OF BRITISH BREEDS OF CATTLE.

However much the substantial merits of short-horns in Great Britain, as well as in America, may have been damaged within the past twenty years by blind allegiance to what has been called "fashionable breeding," it is evident that the "color craze," which prevails to so great an extent in the United States, has not yet had any serious effect on the other side of the ocean. In the stables, the pastures, and the show-yards of England and Scotland I saw comparatively few red short-horns. Roan appears to be the favorite color there; the all white being quite as frequently met with as the all-red. In the show-yards the rich red-roan—a color that is peculiarly characteristic of the short-horn breed—appears to be in a decided majority over all others.

In point of real merit, however, I think no candid man who has seen

the cattle of both countries will dispute my assertion when I say that, judged by the cattle shown at the Royal this year, English short-horns are not equal to those shown at our leading fairs in America. There were no representatives of the breed at the show of the Royal Agricultural Society, at York, this year, worthy of being compared with the show herds that Potts, Pickrell, Sodowsky, Croft, and Palmer exhibited throughout the Western States at our principal fairs last year. In this opinion I am sustained by every American "cattle-man" that I met at York during the Royal show, and there were several of them—Hereford, Angus, and Devon, as well as short-horn breeders. With the exception of the yearling and the two-year-old heifer classes, I thought the show weak throughout, so far as quality is concerned, although it was quite strong in numbers. At this writing I have not read any of the comments upon this show by the English press, so I am not prepared to say whether it compares favorably with its predecessors or otherwise; but, judging by what I heard among the breeders, it was certainly up to, if not superior, to the average of the past six years.

The show of breeds, other than short-horns, at the Royal was not large. The Herefords were reasonably good, the cows very fat and very "patchy," as a rule. There was a fair show of Welsh cattle—vigorous looking animals—uniformly black and possessing a good deal of "style"; they impressed me as being really much better beef cattle than I had been led to believe from what I had previously heard of them. There were a few very good Aberdeen-Angus and Galloways, but these breeds were not largely represented.

From my stand-point the very best beef animals I saw at York were of the Devon breed. Of course they were not so large as some of the other breeds, but they were as square and blocky almost as model Berkshire pigs, on very short legs, with fine bone, neat heads, and such handlers! As an old butcher remarked in my hearing, they were "all good beef from 'orns to 'ocks."

I also liked the red polled cattle of Norfolk and Suffolk quite well. They are much like the Devons in shape and color, but are hornless. While they possess all the characteristics necessary to entitle them to rank as a distinct breed, yet it is conceded that the cattle of Suffolk have been a trifle coarser than those of Norfolk—a difference, however, that is fast disappearing under the system of blood-mingling that is now practiced between the two counties. In addition to a high order of merit as beef producers, the Norfolk and Suffolk breeders claim great superiority for the cows of the breed as milkers, and certainly their published records go far toward sustaining the claim. To those who have a decided preference for hornless cattle, yet with a dislike for the black color, I can heartily recommend these beautiful red cattle of Norfolk and Suffolk.

The show of Jerseys at the "Royal" was much larger than that of any other breed, except the short-horns, and many of the cows carried

with them evidences of large milking capacity. The Ayrshires were not conspicuous, either in numbers or in quality, and the honors in the dairy classes were carried off by the short-horn cows. I may remark here that the prevailing type of short-horn cow, as exhibited at the "Royal," approaches much more nearly to that of the model dairy cow than does the type usually met with in our American show-yards. They are more after the "wedge-shape" pattern—heavy in the hind quarters and tapering toward the head—than is considered the highest model of form in a beef-producing animal.

Next to the "Royal," the most important agricultural show of Great Britain is that of the Highland Society, held this year at Inverness. The leading feature was, of course, cattle, and of these the Galloways, Highlanders, and Aberdeen-Angus took the lead. Many who had made entries here, however, as at York, were deterred from bringing their cattle on account of danger from the wide-spread infection of foot-and-mouth disease. Among others there were many entries from Sir George McPherson Grant's famous Ballindalloch herd of Aberdeen-Angus cattle, but fear lest they might incur the dreaded infection finally led Sir George to keep his favorites at home, although several of his choicest animals had been especially fitted for this show, and with every prospect of carrying a large share of the honors back with them to Castle Ballindalloch.

The short-horns were not numerous, but there were a few good ones; notably Goldfinder, a yearling bull bred by William Handley, Greenhead Milnthorpe, got by Sir Arthur Ingram (32490) out of Princess Flora, by Alfred the Great (36121). This young fellow, a beautiful red roan, exhibited by James Bruce, who is recognized as one of the best feeders in all Scotland, was shown in the very pink of condition, and is certainly the best young bull I have seen this year. He deservedly won the highest honors in his class and also the gold medal as the best short-horn bull of any age in the show. Among the other short-horns there was nothing particularly noticeable; and certainly any of the American herds mentioned above would have had an easy victory over the best of them in the show ring. I cannot help repeating here my strong conviction that our best American short-horns are superior, as a general thing, to the best I have seen here, either in the shows or at home on the farms of the breeders. The best specimens of the breed I have seen (with the exception of the young bull above mentioned) were on the pastures of the farmers of Aberdeenshire—beautiful, smooth, fine boned cattle—such as would delight the heart of a Smithfield butcher.

The West Highlanders were numerically stronger than any other breed at Inverness, and with the Scotch people they appear to be prime favorites. I fear, however, they are too slow in maturing, and too small to be of value to American breeders. Hardiness they undoubtedly possess to an unusual degree, but if hardiness alone is what our Western

ranchmen want they can get plenty of that characteristic by taking a cross back to the Texan or to that still more hardy and better "wrestler," the American buffalo. I take it that what is wanted by our Western ranchmen is a cross that will give earlier maturity, fineness of bone, lightness of offal, and a greater tendency to take on flesh. The quality of hardiness is already attained in the foundation stock.

For the same reason I am rather disposed to question the desirability of the Galloway as a cross for our Western ranchmen. Hardy they undoubtedly are, and of most admirable form in carcass, but I have a fear that this cross upon the foundation stock in use on our Western plains will be found coarse-boned and slow in reaching maturity. I venture this as an opinion, based entirely upon the prevailing type of these cattle as I have seen them in their native country. When mature I am inclined to think they are superior in shape of carcass, judged from a beef-producing standpoint, to their rivals, the finer-boned, finer haired, and earlier maturing Aberdeen-Angus, but as a cross for the purposes above indicated I certainly look for much more satisfactory results from the latter breed, unless it be upon herds that have already been improved by several crosses with the earlier maturing breeds.

Among the herds visited by me in this country I have been especially pleased with the short-horns of Hugh Aylmer and Amos Cruickshank, and the polled herds of Sir George McPherson Grant and Mr. George Wilken. Mr. Aylmer is an ardent admirer of the Booth sort, and as his breeding is confined to that line his herd may be fairly taken as a representative one of that family. His cattle are distinguished for blocky, beefy form, on short legs, with well-sprung ribs, and straight top and bottom lines. Not remarkable for fineness or smoothness, or style, or finish, but certainly most excellent beef-producing cattle.

Mr. Cruickshank is not a follower of either Booth or Bates. He has been breeding short-horns at Sittyton for about fifty years; says it has always been his aim to breed good short-horns, regardless of the caprices of fashion; has tried bulls of both Bates and Booth sorts, but thought they did his herd harm rather than good, and so discarded first one and then the other. The bull that, in his opinion, has been most productive of good results in his herd—the greatest short-horn bull, in his judgment, that has existed within the past fifty years—was Champion of England, a bull bred by himself. He used this bull on his herd about ten years. Among the sons of the old bull he regards Roan Gauntlet as the best—but little, if any, inferior as a getter to his illustrious sire. He has now about 120 females in his herd, nearly half of the number being red, the balance red-and-white and roan, with a few all white. His cattle were not in high condition when I saw them; they were running out on pasture, and had not been in stable, nor had they seen any other feed than grass since last spring. I was particularly impressed with the evidences of early maturity in this herd; indeed I have nowhere else seen such perfectly developed *cows*, among

yearlings and two-year-olds, as at Sittyton; and it is here I think that the chief excellence of Mr. Cruickshank's breeding lies. This feature has given character to the short-horns of Aberdeenshire, and so universally is it recognized, that even the breeders of the Aberdeen-Angus cattle of that region all concede, so far as I heard an expression of opinion, that up to two years old no breed will show such a gain as the short-horn. Mr. C. says his aim has been to produce a first-class beef animal at the earliest possible age; and in selecting his breeding bulls, he says: "The only questions have been, is he a good short-horn? and, Will he nick well with my herd?"

I have seen much of the Angus-Aberdeen cattle on their native heath—on the pastures of the common farmers of Aberdeenshire—and I certainly like them well. They are good-looking, smooth, fine-boned, early-maturing cattle wherever you see them. The Ericas (a family of this breed), as bred by Sir George McPherson Grant, pleased me best, on account of their comparative lightness of bone and compact, level, beefy, carcasses. Sir George has either succeeded in fixing a strong family type in these Ericas, or else he has shrewdly retained those that approximate closely to this type among those bred by him, and has sold the rest. The Prides (another popular Aberdeen-Angus family) are larger than the Ericas, and certainly have not quite the finish and style of the latter, but, judged by the show-yard triumphs of this year, they are not a whit behind them in popular favor; indeed I am inclined to the opinion that the show-yard ledger of this year displays a decided balance to the credit of the Prides. But this may be, to a considerable degree, owing to the absence of the Ballindalloch herd from the Highland show.

I regret exceedingly that I was compelled to forego the pleasure of a visit to Herefordshire. The "white-faces," as the Hereford cattle are often called, have gained so firm a footing and have become so widely popular in America that I very much desired to see them on their native pastures. I had arranged, while at the Royal show, to spend all of the last week of my stay in England among the Hereford breeders, timing my visit there, by special invitation, with reference to an important gathering of Hereford breeders that was to take place at that time, but at the last moment I was compelled by urgent business demands to send my regrets to Hereford and turn myself homeward, without the coveted visit to Herefordshire, as well as to many other places that I had hoped to see before my return. What I have seen of this very popular breed, however, has only confirmed my previous favorable impression of them as grazing cattle. But must I be permitted to say of them, as I have already said of the short-horns, that judging by what I have seen of them in both countries, the enterprise and good judgment of American buyers have already transferred the cream of the breed to the United States.

ENGLISH AND SCOTCH DRAFT HORSES.

Another very prominent feature of the English and Scotch show-yards was the cart or draft horses, the Clydesdales taking the lead in Scotland and the shire horses in England. So much crossing and mingling of blood has been practiced by the horse breeders of these two countries that it is really very difficult to tell where the one leaves off and the other begins. In fact, I have never yet been able to find a horseman whose eye was critical enough to enable him to say positively whether a given animal belonged to the one or the other breed, unless he knew beforehand who the animal belonged to, or where it came from. But as each breed now has its own stud-book it is not unlikely that a greater distinction than is now apparent may grow up in the near future. Judging by what appeared to be the prevailing type of the two breeds, as I saw them, I should say, if there is any difference in them, that the shire horse was relatively better and stronger in the heart, back, and flank, than his Scotch rival; but, as before remarked, the most critical horseman would be puzzled to give a good reason why they might not be classed as one and the same breed. They are certainly most excellent horses, and for heavy draft it is doubtful if their superiors can be found in any country. Large numbers of them are now annually being taken to the United States, the honors being about equally divided between them and the Percheron horses of France. The Clydesdale and the Shire horses have each had a stud-book for some 5 or 6 years past, and the effect has doubtless been to cause greater attention to be paid to genealogy than was possible under the former order of things; and American importers now have a much more reliable guaranty of purity of blood than they could possibly have without these published records. With the publication of the Percheron stud-book, to which I have before alluded, it may now be said that our American importers have a stud or herd book to rely upon for every breed of horses and cattle that is brought to our country, whether from Great Britain or the Continent.

DANGERS FROM INFECTIOUS DISEASES.—SUGGESTIONS AFFECTING OUR EXPORTS OF LIVE CATTLE.

In conclusion permit me to say that I am aware of the fact that I have only imperfectly covered the subjects to which my attention was directed by you in my appointment. The time which I was able to give to each branch of the subject was necessarily brief; and some of them I have been compelled to forego almost entirely. I cannot close, however, without again calling attention to the very general prevalence of foot-and-mouth disease among the cattle of Great Britain, and the great danger which exists of the transportation of this pest to our own herds and flocks, through the frequent importations that are now being made from that country. The system of quarantine now being maintained by our

Government against all imported cattle affords very good security against infection, through the bovine species; but sheep, swine, and goats, are equally susceptible to this disease, and are quite as likely to bring it to our shores as are the cattle. Unfortunately there is no law authorizing a quarantine of any imported animals other than cattle, and herein lies our greatest present danger. It is to be hoped that Congress may be induced at a very early period in its next session, to confer the necessary authority for enforcing quarantine against sheep, goats, and swine, as well as cattle from all foreign countries, so that our flocks and herds may be effectually guarded against this the most infectious of all animal plagues.

I deem it important also to call attention to the fact that the establishment of a rigid system of inspection of all live cattle exported from this country and a strict supervision of the ships used for the purpose of carrying the cattle from our ports, to the end that none but healthy cattle shall be placed on board and that the facilities for promoting the health and comfort of the animals during the voyage shall be ample, is of the highest possible importance in its bearing on the future of our export trade with Great Britain. In a conversation between Professor Brown, the chief veterinary adviser of the British privy council, and myself upon this point, he dwelt with especial emphasis upon the importance of attention to these matters on the part of our Government. Americans as a class are very jealous of governmental interference with trade and commerce, and cattle shippers especially are opposed to any regulations that shall interfere in the least with their present freedom of action. But the interests of the farmers of the United States, the men who raise the cattle for export, are paramount to those of the few who are engaged in the export trade. And no consideration of a very slight reduction in the per cent. of profit which these dealers may realize should be allowed to stand in the way of the adoption of regulations which are absolutely essential to the permanence of the traffic.

Respectfully submitted.

J. H. SANDERS.

CHICAGO, *October 30, 1883.*

REPORT OF DR. RUSH SHIPPEN HUIDEKOPER.

SIR: Twenty years ago an International Cattle Show was held at Hamburg, Germany. This exhibition attracted a great deal of interest; it proved a financial success to the citizens who guaranteed the cost; it brought valuable agricultural products and animals from England, France, and other countries, and it was encouraged by numerous exhibits and an active committee from the United States. The effects of this exhibition in North Germany were lasting. Valuable breeding animals were bought from the foreign exhibitors, and the numerous German farmers who attended saw and appreciated the improved

methods of tilling the soil, breeding, caring for and feeding their animals, and economizing the products. Some of the committee of the exhibition of 1863 were still taking an active interest in agricultural matters when the present Hamburg Cattle Show was proposed, and they found a prompt support in offering to the people another "conours" to show the advance which had been made in the two decades. In the exhibition of 1883 but few of the foreign countries lent the support which such an undertaking deserved, and the exhibits were confined almost entirely to Germany, with her closely related neighbors of Holland, Denmark, and the Austro-Hungarian Empire.

The exhibition was opened on the 3d of July, 1883. The buildings were well arranged and every accommodation for the animals was provided, the details of which will be found in the accompanying catalogue.

The exhibits were divided into nine sections, viz :

1. Horses.
2. Horned cattle.
3. Sheep.
4. Swine.
5. Bees and the apparatus connected with their care.
6. Fish.
7. Fowl.
8. Stalls, buildings, agricultural implements, &c.
9. Scientific apparatus and methods of teaching all matters pertaining to agriculture.

SECTION I.—HORSES.

Division A.—Classes 1 to 4 were composed of thoroughbreds, which presented no particular interest. Among the stallions one of the best was an American, "Imagination," born 1874, by Longfellow out of a Lexington mare.

Classes 5 to 6 contained several excellent Arabs, which have been of great use in Germany, as in France and elsewhere, in improving the local breeds of horses before crossing them with the thoroughbreds.

Division B.—Classes 7 to 12 called for riding, hunting, and cavalry horses and mares, of three years and over, raised in Germany, Austro-Hungary, Denmark, Sweden, and Norway. These classes were largely filled with good animals, especially from Austria, as the horses from this country showed much more blood.

Division D.—Classes 13–15 were for the same class of animals from any country. England only of foreign countries was represented with several good animals from the Stand Stud Company, but the first prize was awarded to the representative of the Royal Prussian stud. In this division American horses could have been shown with special profit. Equally good horses might have been sent from New York State and the whole Alleghany ridge, with an advantage of price on their side, even with the cost of transportation and risk added.

Division E.—Foals of the previous classes.

Division F.—*Heavy carriage horses.*—This division was complete in stallions, mares and colts, and presented, perhaps, one of the richest shows among the horses. From the many studs represented the most useful for the United States would probably be the animals of the Grand Duke of Oldenburg. These are magnificent beasts of full 16 hands, short coupled, fine, strong neck, legs well placed (*d'aplomb*), and good feet. The developing horses are of sufficient size for the farmer to use economically while he is preparing animals, which, if they are at fault as valuable carriage horses, are still strong enough to sell or keep for hard work.

Division G contained, in addition to the preceding, a few good English horses.

Division H.—Strong horses for agricultural and industrial work. The Clydesdales were entirely wanting. Several fine representatives of the Shire horse were shown, the largest weighing some 1,900 pounds, but all except a stylish mare were sleepy and had unfortunately flat feet.

Classes 31 to 34 failed to obtain any representation from the superb French, Belgium, and Norische or Pinzgauer races. The first two are so well known in the United States that it is useless to speak of them, but the Pinzgauer should be better known. Originating (historically) in the Pinzgauer and Styria these immense active horses have ever since been kept in all their purity. They were described and drawn from by the ancient Romans, and in the Middle Ages they furnished the mounts of most of the German and North Italian warriors. Their full blood has always exercised a strong influence upon the countries directly surrounding the South of Austria, but the limited territory in which they are produced in their purity has been a barrier to their wider dissemination, and of late years their export has been almost entirely limited to Munich and Vienna. Fine examples of this race can be met with in these two cities, but they are best seen on the Styrian Mountains, where they usually work with a load on the back and go over the heights, on a narrow foot path, as surely as a mule, with the advantage of greater speed and the strength for a greater load. As our agriculturists are now bringing so many of the large European horses to America, and the price of English and French horses have advanced so much in the last few years, it would be well for them to pay attention to these animals, which can be procured for less money. From Denmark were shown some fine horses with a good deal of blood and weighing from 1,300 to 1,500 pounds.

A few Ardenners were exhibited in harness, but none of the pure type which was so renowned in the old posting service, and has now become so rare, as it has unfortunately been rendered coarse and lymphatic by crossing with the large Flemish and English animals.

SECTION B.—PONIES.

Among the ponies no type or race was especially exemplified, except from Norway. The Scandinavian horses are magnificent heavy ponies of 13 to 14 hands, with short backs well modeled, short, strong set legs, good feet, and an intelligent head with a large open eye.

These animals keep in good condition with a small quantity of poor food, and are adapted to mountain work. They walk very fast and trot wonderfully. They are good workers in harness, though they are usually used under saddle, and carry the big Norwegian peasant as easily as they would a child. They could be profitably raised in any of the mountainous districts of America, and would make an excellent mount for the cavalry in the West. Their price is very low, and the cost of transporting them would be less than for large horses. There was no exhibit of mules and asses.

SECTION II.—CATTLE.

The show of cattle was the great feature of the exhibition, although it was almost confined to the series of coast cattle. The present division of these cattle deserves special attention, as the American nomenclature has been decidedly arbitrary.

It is only within recent date that the proprietors and agriculturists have become convinced of the necessity of establishing definite lines between the cattle of each locality, where the animals showed some particular merit; and in order to retain the purity of their herds, which was threatened by the increased facilities of commerce, they have found the solution of their problem in the establishment of "herd books."

The catalogue called for a first division into the *Marschschlage*, or those families of animals coming from the lower country and into the *Geestschlage*, or those coming from the higher and more inland countries. In the *Marschschlage* series are the East Frisians, Oldenburgers, Hollanders, Wilstermarsch, and Breitenburgers; in the second series there are families from the first three of the preceding, the Angelers and the Jutlanders. Of these groups the Wilstermarsch, Breitenburgers, Angelers, and Jutlanders are in general terms "Holstein" cattle, and, except the last, have nothing whatever in common with the West Frisian, Oldenburgers, and Hollanders, which are the so-called Holstein cattle in America. The generic name of "Holstein" as applied to any race of cattle does not exist in North Germany or the Netherlands. The Wilstermarsch and Breitenburgers present no special interest for the American, as they are simply two good breeds of cattle which are fair milkers, and owe their milk qualities to the crossing of short-horns on the large native race, a bony and coarser cattle. The Jutlanders, Oldenburgers, and a part of the Frisians, especially that part of the latter to the east, have also felt the influence of the short-horns to a very great extent, but the native breeds were generally

strong enough to retain their color and their milking qualities. The continental preference, which formerly bought only white short-horns, aided probably in the retention of the white and black color. While some of the families of those breeds are almost typical short-horns in form, a large number approach the Dutch and Frisian so closely that mistakes between them would be excusable. However, the lower flank, the larger hip, the finer development of the thorax, the shoulder-gutter, the fine head, and the other milk characteristics distinguish the families from Holland and Friesland. At present the most of these cattle, if of any value, are registered in the herd books. While the name of a herd does not affect its value, it would be better that the proper name should be given in the establishment of foreign herds in the United States. The two groups of these cattle, with their predominating qualities of milk or beef, should be better understood and separated at the outset.

The Angler cattle are a beautiful race of milkers, with most of the characteristics of the Channel Island cattle, including the richness of the fatty parts of the milk, but they have their beef qualities better developed. They are of a uniform red color, with black muzzles and legs.

The Swiss cattle were scarcely represented by a few Simmenthalers and Allgauers, while the other celebrated breeds were absent. The few examples of the beautiful Swiss cattle in the United States are too little known. Their special adaptation to high regions, their great milking qualities and economical transposition into beef, would make them a most profitable animal in the high cheese-producing counties of New York, Pennsylvania, and elsewhere.

The Austrian and Russian cattle were wanting. A few Rhenish (Jura) and Scandinavian cattle presented only a zootechnical interest, and the great milk race of Flanders and the North of France, and the Salers and other great work and beef cattle, were entirely absent. The short-horns and Ayrshires were shown both from German and English herds that would readily have yielded the prizes to American representatives had these been sent. A test of the quantitative and qualitative milk production of the various races was carried on during the exhibition, of which an analysis is subjoined.

SECTION III.—SHEEP.

This section was only notable for the magnificent specimens of the Rambouillet merinos, which are owned in quantities in many parts of Germany.

SECTION IV.—SWINE.

The exposition of hogs contained many fine Yorkshires and Berkshires, both from German and from English proprietors; but the finest show was in Poland Chinas, which were almost all imported from the

State of Ohio, and they attracted a great deal of attention and favorable comment.

SECTION V.—BEES.

In this division was a complete collection of the breeds of bees, with all the apparatus connected with their raising and the utilization of the honey and wax.

SECTION VI.—FISH AND FISH BREEDING.

Besides a show of the implements connected with fishing, a few models of fish-breeding and artificially developed fish were shown, among which was the fine collection of carp from the farms of Adolph Gaschat Kaniow, in Galizia. This exhibit requires, however, no details after the larger ones which have recently been held.

SECTION VII.—FOWLS.

As no foreign exhibit was made, the collection of fowls can best be criticised as being composed of German birds. The representation of pigeons was wonderful, and the catalogue will probably be of interest to breeders of these semi-luxurious but useful birds.

SECTION VIII.—STABLING, MACHINES, AND IMPLEMENTS.

The moderate exhibit of wagons, agricultural implements, &c., was almost entirely from the hands of German and English workmen, and certainly would have been much more valuable if it had had the addition of the standard American machines. The few machines which were modeled from American patents were of old patterns.

SECTION IX.—SCIENTIFIC INVESTIGATION AND PRODUCTS IN REFERENCE TO ANIMAL INDUSTRY.

This section contained an exhibit which would possibly have been one of the least understood at first sight by many Americans, but when once studied would have been thoroughly appreciated and would have proved of great usefulness in showing the extent to which European governments interest themselves in aiding the agriculturist, by furnishing him with properly educated men to assist him in the selection and care of his land and animals; and to care for his animals and protect them when they are sick or are threatened with the epizooties. The first collection was a well selected museum of the books, specimens, apparatus, and zootechnic products from the Royal Prussian Agricultural High School in Berlin.

The second was a similar collection from the Saxon [Agricultural School. This included a complete display of wool from all] the ovine races and breeds, with an appendix giving a detailed report of the feeding and producing cost of the animal which furnished the samples.

From the veterinary department the exhibits contained a collection of skulls of all the domestic animals, anatomical and pathological specimens, injected preparations, parasites and wax models of the same, apparatus connected with the use and care of the domestic animal, &c. An interesting selection from the library showed the gradual development of literature pertaining to agriculture.

The veterinary school and school for blacksmiths, of Saxony, were also represented by complete examples of their methods of teaching and the means employed in their practical demonstrations.

Instrument makers showed microscopes, trichina microscopes, thermometers designed for stable and dairy use, lactometers, apparatus for qualitative milk analysis, &c.

Agricultural and veterinary literature was completely represented, and contained many useful models of records for dairy and farm use, and an extensive collection of all existing stud and herd books. Silk and bee culture was shown by a full series of the natural insects and their products, and a duplicate series of the same, enlarged in wax and papier maché. There were also competitive prizes for essays and designs for stables and farm buildings, to be adapted to flat or hilly countries; essays on the hygienic and other arrangements of farm buildings, manure, &c.; on the removal of animals from burning buildings; on animal production (breeding), &c.

Throughout the entire exhibition the most rigid measures were observed in regard to the sanitary police. A sufficient corps of veterinarians was constantly on duty, under the direction of Professor Johne. All animals before being admitted to the show-grounds were passed through an inspection yard and carefully examined. A constant watch was continued, and notwithstanding the immense number of animals collected from all of Central Europe and transported through the great centers of animal commerce on railway wagons and by other means of public conveyance no cases of contagious disease were detected, and none developed during the ten days on the grounds. This fortunate result is justly to be attributed to the present complete and thorough precautions taken by the German Government for the protection of its animals. Each district is provided with an official veterinary surgeon, to whom all cases of contagious disease must be reported, and this official is empowered with the proper authority for enforcing the law. Each department has a superior veterinarian, to whom the district veterinarians report, and he is invested with greater powers. If the proprietors make an immediate report of any suspected case of contagious disease on their farms, they are liberally indemnified in case of loss, after the official investigation, which is one of the official acts in Germany, and executed promptly. If, however, a proprietor attempts to conceal any case of contagious disease in his animals, he not only forfeits any right to indemnity, but is punished. A veterinary surgeon who attends such cases and does not report them is even more severely punished. This

law of liberal indemnity and punishment combined has proven most satisfactory ; it leads to the prompt declaration of any outbreak of disease, and allows the Government to exert active measures at the outset. In addition to these rigid measures, the precautions taken on all means of transport for their proper disinfection are thorough, not only in the law but in practice. Railway cars which have served for the transport of any of the domestic animals are immediately disinfected. The large railroad yards are provided with special tracks at the side of a building containing boilers for an unlimited supply of hot water. After the car is swept it is washed from a hose with water as hot as can be handled; after another sweeping the interior of the car is washed with water heated to 70° C., with soda added. This most satisfactory means of disinfection is carried out at an expense of only two marks (50 cents) a car, and is paid by adding that amount to the freight bill.

The slaughter of all contaminated animals, whether executed as a measure of sanitary police or for food, is done under the supervision of a responsible veterinary inspector, and so all attempts to evade the law for a little additional gain are avoided.

It is greatly to be regretted that Americans could not have been enabled to exhibit their agricultural products, especially animals, at Hamburg, that they might have shown the great resources of the United States, and, what is more important, the facility with which these resources can be placed at the disposal of the European market, as this is as yet little appreciated outside of England. The cavalry horse and the beef cattle are now the two articles which offer a favorable and profitable field for export, but it will be but a very few years before the heavy draft horse can be added to the list. For the establishment of an active and paying commerce, however, the European Governments will demand a greater security and guarantee of the health of the animals shipped to them than now exists. The necessary encouragement for the education of a sufficient number of men to carry out the State laws and the work of the Government in regard to the diseases of our animals will aid very materially not only in our own protection, but in the advancement of our cattle trade with Europe.

Very respectfully,

RUSH SHIPPEN HUIDEKOPER, M. D.,

Honorary Commissioner.

HON. GEORGE B. LORING,

Commissioner of Agriculture.

OUTBREAK OF SOUTHERN CATTLE FEVER IN KANSAS.

REPORT OF M. R. TRUMBOWER, V. S.

Hon. GEORGE B. LORING,

Commissioner of Agriculture:

SIR: In obedience to your telegram, dated at Washington, October 9, 1883, requesting me to proceed at once to Harper, Kans., there to investigate an outbreak of disease among cattle, I forthwith made the necessary preparations and left on the 4 o'clock train the same day, arriving at Harper on the morning of the 12th. My instructions not having yet arrived, I remained in town and made inquiries of different individuals in relation to the cattle disease. I soon became overwhelmed with reports of the magnitude of the outbreak and extent of losses throughout Harper and Barbour Counties. I received many reports from different individuals, stating that such and such persons had cattle dying daily at that date. After deliberating over the matter, I came to the conclusion that I could do no better than to remain in town over Saturday and have some person who was well acquainted with the people to point out to me the men who were then losing cattle, as many of them would probably be in town on a Saturday. Here I met with disappointment. I met a number of men of whom it was said that they were losing cattle daily, but on making a direct inquiry they almost invariably said: "No; *they* were not losing any now," but named some other person who was. I soon found out that the better plan would be to go directly into those sections where the greatest mortality had prevailed, and there endeavor to find suitable subjects for examination. Therefore, on Sunday morning, the 14th, I made arrangements with Martin Cochran, of Harper, who is well acquainted with that country, to take me out into Barbour County. We left Harper about 8 a. m. The first place we stopped was at Dr. Joseph Brockway's, on the Nine Cottonwoods Creek, 18 miles southwest of Harper, in Harper County. He made the following statement: That he moved his cattle, numbering 75 head, from his place of residence, taking them northwest 2 miles, on or about the 1st day of May; that on or about the 10th day of July his cattle began to die, and 10 head died within eighteen day's time, nearly all of them being two and three year steers. The disease then abated, rainy, cloudy, and cool weather supervening. On the 1st of August 4 or 5 were still sick, but making a slow recovery. On the 12th of September the disease broke out again, and

13 head more died in rapid succession. He then fenced in a pasture for his cattle, placed them therein, and has not lost any since.

The Boyd herd of cattle (suspected—of which more hereafter) were driven on their way west from Harper into Barbour County, along a freight road which crosses his range, upon which road also oxen attached to wagons and small herds of cattle were driven back and forth all summer, and cattle passed in the care of herders every morning.

Mr. E. Walden, 2 miles north of Dr. Brockway's, lost all the cattle he had—7 head. They died in the month of September. His cattle have been near the Boyd trail, and also near the Anderson trail (another suspected herd).

The next place I visited was William A. Wood's, on the line of Harper and Barbour Counties. He made the following statement:

Mr. Boyd, in the month of April, crossed my range with his cattle; I drove my cattle back, 13 in number, to allow him to pass. A few days later a second herd, numbering 900, were driven through on the same trail. I again turned my cattle back to allow this second herd to pass; they stopped on my range to graze for two hours; they then went west to the Little Sandy, where they turned and went northwest. These cattle were long-horns. I picketed 1 cow and 2 calves on the trail of these two herds. The cow was taken sick on the 1st of October, and died on the 12th. All of my cattle crossed this trail daily; 5 of them were taken sick, but only the 1 died.

I went out on the range to see the one that died on the 12th (two days ago). I found her in a fair state of preservation, and decided to make a *post-mortem* examination. I removed the wall of the chest and abdomen of the right side. Found the lungs in a nearly normal condition; the pericardium contained four ounces of bloody colored serum; the heart was extensively ecchymosed on both the external and internal surfaces, the endocardium being somewhat softened and paler than normal; no heart clots were present. The liver weighed 13 pounds, the enlargement being due to hyperæmia; gall bladder contained 10 ounces of a dark olive colored bile, of a thicker consistency than normal; spleen weighed 4½ pounds; contents, a dark purple semi-fluid pulp; a general disintegration had taken place; urine bladder empty; kidneys normal in color and size. The fourth stomach presented extensive congestion of the mucous membrane, especially towards the cardiac end, and many small erosions exposing the vascular membrane were visible near the pyloric end; redness and congestion, accompanied more or less by thickening of the mucous membrane of the small intestines, was manifest upon close inspection; interstitial extravasations of blood between the membranes of the cæcum and also of the rectum were found, and the feces coated with mucus mixed with blood. The uterus contained a male calf six and a half months old; the liver of the fetus weighed 1½ pounds; spleen apparently normal; pericardium contained 2 ounces of very dark-colored bloody fluid, also an abnormal amount of bloody colored fluid was discovered in the thoracic cavity.

I examined a white cow, six years of age, which was supposed to be recovering; she had been sick for two weeks; pulse 112, temperature

106° F. She was lying down. I made her get up; her gait appeared very stiff and painful, and as she slowly moved away she voided bloody-colored urine. She eats and ruminates. I examined another cow which had been sick for ten days; pulse 66, temperature 104° F; very thin in flesh; eats and ruminates. October 24 saw Mr. Wood in town; he stated that both the cows which I examined were alive and gaining in strength and health.

From Mr. Wood's place we proceeded to Mr. Jesse Boyd's, in Barbour County. Here we remained over night. During the evening and the following morning I received the following information from Mr. Boyd and Mr. Cochran, viz: Mr. Martin Cochran, of Harper, spent nearly all winter at Judsonia, on Red River, White County, Arkansas. Mr. Cochran bought 342 head of cattle in this county, most of them being in a very poor condition, attributed to cold weather and insufficient feed. One hundred of this number were bought 12 miles north of Searcy. Mr. Cochran collected 242 head and drove them to Judsonia on or about the 24th day of March. Mr. Jesse Boyd came to White County, Arkansas, about the 1st day of February. He bought 228 head of cattle in this county, brought them to Judsonia, and there he and Mr. Cochran pooled their cattle, the combined herd then numbering 470 head. They drove them 55 miles to Conway, a railroad station, adding at Searcy 100 head more (those which Mr. Cochran bought 12 miles north of Searcy). They shipped at Conway, on the 1st day of April, the whole number of the combined herd (570) and unloaded at Harper, Harper County, Kansas, on the 5th. About 50 of them died on the cars before they arrived at Harper; got down in the cars and were trampled to death. At Harper these cattle (520) were kept for three or four days, ranging north of the railroad track and traveling over a space of 2 miles, the range extending northeast to Sisson's Grove and to a small creek where they had to go to water. At night they were yarded at the stock-yards.

Twenty of them being disabled were watered in the yards and fed on corn, cane, and millet-hay for a week or longer. On the 9th of April Mr. Boyd drove 500 head of them from the stock-yards, in a southwestern course, to the edge of town, passed I. J. Campbell's field, thence west 1 mile, then southwest 1 mile, west again 8 miles, crossing L. M. Pratt's range one-half mile north of his residence, then came on the road at the school-house on Bluff Creek, thence along the main road as far as Richard Botkin's place, beyond whose place they encamped one night. From there they left the road to the south of the trail, but came back to the road again at W. E. Kline's. From Kline's they passed in a southwesterly direction to the Nine Cottonwoods Creek, east of Mr. Gardner's; here they stopped the second night. From this place they passed due west until they reached Boyd's range, on the Little Sandy Creek, 4 miles across the Harper and Barbour County line. From Boyd's range 102 head of these cattle drifted away and were gathered in again in the round-up in June and July. They went south to the line of the

Indian Territory, west 12 miles to Medicine River, east 2 miles to the limits of the range. On the 10th day of July several of these cattle were noticed to be sick, and in a week 8 were dead. Mr. Boyd, at the same time that he held this herd of cattle, also had 140 head of Arkansas cattle which he brought in last year, and were wintered by him; he had 20 head of natives besides, which were also wintered by him. At the time that the recently imported Arkansas cattle began to die, two of the natives also became sick and died, both the latter being yearling heifers. All of these three different lots of cattle were herded on the same range and drank out of the same creek until the latter part of July, losing 8 of the suspected cattle, two of the natives, and none of the wintered Arkansas cattle.

The 20 head of crippled cattle which Mr. Boyd left at Harper were driven into I. J. Campbell's pasture field, located at the western edge of town, on or about the 18th day of April; there they intermingled with 150 head of native cattle belonging to Mr. Campbell. They remained in Campbell's pasture for a week, then they were driven out over the trail of the previous lot of cattle, as far as L. M. Pratt's, where they remained over night grazing with some of Pratt's cattle. From Pratt's they went in a direct course to Boyd's range.

On the 26th day of July, Mr. Jesse Boyd was arrested and brought to trial for bringing into the State of Kansas, contrary to law, wild and undomesticated cattle, which had spread a disease among the natives known as Texas fever. Four hundred and thirty head of the Boyd cattle were seized and quarantined by the sheriff of Barbour County, were placed into Mr. Cook's pasture field, 2 miles south of Mr. Boyd's house, and there were kept under surveillance by the sheriff's assistants. The witnesses on part of the State were: William Garrison, Mr. Hufacker, David Clough, W. W. Cook, Albert Cook, M. B. Moore, George M. Gardner, J. H. Warren, A. B. Rannels, W. E. Mattox, all men holding cattle close to Mr. Boyd. Mr. Boyd was fined by the court in the sum of \$300, and sentenced to imprisonment in the county jail for a term of one month. He took an appeal to the higher court. His second trial has not yet taken place.

On the 15th of October, I went to see Mr. Jackson, who has charge of the quarantined cattle. He reported six deaths among them since the 29th of July. On the 18th I was again at Mr. Boyd's place. I then tested the temperature of 4 head of his wintered cattle which registered as follows, 101.8°, 100°, 101.4°, and 100.9° Fahrenheit. I proceeded to the quarantined herd and tested the temperature of 20 head among them. We drove them into a branding pen. They registered as follows: One four-year old cow, 102.1°; two-year old heifer, 103.7°; three-year old steer, 101.6°; two-year old steer, 103.4°; yearling heifer, 102.6°; three-year old heifer, 103.7°; pulse, 66; two-year-old heifer, 101.8°; two-year old heifer, 102.9°; yearling heifer, 102.2°; four-year old cow with calf at her side, 102.9°; three-year-old heifer (scouring), 102.4°; three-year

old steer, 102°; six-year old cow, 102.8°; two-year old steer, 102.4°; two-year old steer, 102.8°; three-year old heifer, 102.6°; three-year old steer, 102.6°; ten-year old cow, 103.1°; six-year old cow, 103.2°; two-months old calf of the latter, 104.9°; one lame cow, a stray, ox yoke brand, which has been lying around with these cattle since the July round-up, indicated a temperature of 103.7° F.

These cattle did not appear wild and undomesticated, and stood very kindly under my examination. Here I wish to mention a word about the July round-up. In the latter part of June or the first of July about 2,000 head of cattle were brought to and centered upon Boyd's range in the round-up; nearly all of the neighbors of Mr. Boyd, and many others, came to this place and cut out their own cattle. Some of the strange cattle remained several days on the Boyd range. If any cattle were in this herd that carried the germs of the Southern cattle fever, it follows that all the cattle in this round-up were equally exposed, or nearly so. In this herd of 2,000 were about 10 head of stray cattle, for which no owners appeared, and it is not known to-day where they belong, nor from where they originally came. Again, Mr. R. B. McGee, secretary of the Cedar Hills and Sand Creek Pool, gave me the names of the membership of said pool, as follows: McGee and Lovett, Jesse Boyd, M. B. Moore, William Garrison, Mr. Hufacker, Mr. Beals, David Clough, Perry Clough, John McKeever, John Elmore, Hink, Moore, Munger Brothers, J. H. Warren, E. C. Davis, Mr. Holmes, M. McGuire, and Mr. Cross. All, or nearly all of these parties, had a greater or less number of cattle in this pool during the winter or spring, where they remained until about the 1st of July. If any of the ground over which these cattle passed was capable of imparting the Southern cattle fever, or, if any cattle were in this herd carrying the germs of this disease and discharging them, then all of the cattle in the herd were exposed to such grounds or cattle. On Monday, October 15, Mr. Boyd and Mr. Cochran accompanied me to Mr. John Elmore's ranch, located on range 15 and 16, T. 33, R. 10 W., Barbour County, or four miles southwest of Boyd's range. Mr. Elmore stated that he held on his range 210 head of grown cattle and 40 calves, all wintered cattle except 38 head, which were brought in from Atchison County, Missouri, in the spring. Mr. Elmore's cattle began to die on the 1st day of July; 13 head died in two weeks; the disease then checked up but broke out again about the 1st of September. During this month 143 died, including 3 or 4 spring calves. Out of the 38 head brought from Missouri, 15 died. He states that he does not know of his cattle being exposed to any through cattle, or other diseased cattle, except the Boyd herd. Several of his cattle drifted away in the spring and were gathered in the round-up; one of them was gathered in the Territory round-up some fifty miles south of the line.

Last year Arkansas and Indian cattle were held on this range by Munger Brothers. Late in the fall Mr. Elmore brought 362 head of cattle from Northeastern Kansas and Northwestern Missouri and placed

them on this range; in two weeks thereafter 6 of them died with Southern cattle fever. (See Dr. Detmer's report of last year's investigation—Moore and Elmore.) During the winter they lost 108 head, including the 6 just mentioned, out of the number.

From Elmore's we drove to Cook's and Rannal's, 4 miles southwest of the former, located on the western side of the Cedar Hills. We found no sick animals among this herd; only a small boy was with them, and he did not know how many they had lost.

I saw W. W. Cook at Medicine Lodge on the 27th, when he gave me the history of his losses. He owns a 600-acre pasture 2 miles south of Boyd's residence, which was an open range until the 12th of May, when he fenced it in with barbed wire. He bought from Mr. Perry Clough 140 head of cattle on the 1st day of April. They were wintered on this range. In the month of May 5 bulls were added, and on the 10th of June 217 head of cattle were brought from Kingman County. These 217 head were bought from three different parties—Williams, Lowry, and Fowler. He drove them in two lots. The first lot, composed of 41 head, were driven south along Sand Creek, corraled one night in Mr. Carlyse's corral, 12 miles northeast of Medicine Lodge, and then brought on the range.

The second lot, 176 head, were brought from the Chikaskia River, driven south through Dr. Wisner's range, and on south, crossing Mr. Boyd's range on their way to Cook's pasture, arriving at their point of destination on the 12th of June. His cattle began to die on the 9th of July; on the 14th, 9 were dead and 7 sick. The cattle were then moved south of Rannal's range, south and west of the Cedar Hills; the 7 sick ones were allowed to remain in the pasture, 5 of which died and 2 recovered. On the 29th of August his cattle began to die on the range, and he lost in all 75 out of 331 head; 10 or 15 that were sick recovered. Change of pasture was not beneficial in this case. Mr. Albert Cook, who took care of W. W. Cook's cattle, testified at the Boyd trial that some of their cattle got out of the pasture and others got into it, by breaking down the wires. This must have occurred between the 12th of May and the 14th of July. Mr. Rannal's, north of Cook's range, lost 30 out of 150 head during the month of September. These were close herded since the 1st of July. Mr. Rannal's and a part of Mr. Cook's cattle were exposed to the Boyd cattle, and also to all other cattle in the county round-up.

From Mr. Cook's range we went to R. B. McGee's, on the Little Salty, T. 34, R. 10 W. McGee and Lovett hold 200 head of cattle ranging on the east side of the Little Salty, 1 mile north of Hazleton. The first loss in their herd occurred on the 15th of September; 21 died to date; 8 remain sick, but are recovering. One, a 5-year-old bull, died last night or this morning. I desired to make a *post-mortem* examination of the bull, to which McGee readily gave his consent and assistance. We found him lying on the left side; a few drops of bloody water were dis-

tributed over the surface of his body. I removed the right fore leg and shoulder, the wall of the chest and abdomen. The animal was not *very* fat, but the fat was the color of yellow beeswax, with a slight greenish tint added to it. I removed the spleen, but in doing so I had to use the utmost precaution in handling it so as not to rupture its covering membrane. The organ was of an enormous size, and apparently distended to its utmost capacity, weighing after removal 13 pounds and measuring 30 inches in length. I next removed the digestive organs. The contents of the third stomach were slightly hardened; the lining of the fourth stomach presented numerous and extensive patches of denuded surface of irregular forms, and many of them having an ulcer-like appearance.

There was considerable capillary congestion of the mucous membrane throughout the intestinal canal; a few of the intestinal glands appeared to be enlarged and were changed in color to a grayish black. The liver weighed $24\frac{1}{2}$ pounds; its structure was somewhat softened by a fatty degeneration, and impressions of the fingers were left upon it as is common in œdematous swellings. The gall-bladder contained 32 ounces of bile of normal color, but was rendered more or less viscid and glutinous by the admixture of mucus from the internal surface of the gall-bladder; the walls of the gall-bladder itself were thickened, caused by tumefaction of the mucous coat. The urine-bladder contained a gallon or more of a brownish-red colored urine, specific gravity 1.008. The left kidney weighed $4\frac{1}{2}$ pounds; was darker in color than normal. The glandular structure of the right kidney was entirely absorbed; the pelvis and some of the larger ducts had become changed into cysts, containing a clear amber colored fluid possessing the smell of healthy urine. It presented eight of these cysts, each one distinct and separate from the other, and all taken together formed in bulk about the size of a normal kidney. After the letting out of the fluid, I had nothing in my hand except a mass of fibrous tissue—*there existed not the least remains of glandular tissue*. The heart weighed 8 pounds; was enlarged and flabby; the external surface was extensively ecchymosed along the anterior and posterior ventricular furrows; internally, the fleshy columns were almost of a black color from ecchymoses; no heart clots in the cavities. The animal seemed almost bloodless, the veins and arteries being empty and collapsed. Mr. McGee stated that this animal had been lame for the past fifteen months in his right hind leg, and that at times he thought he could not well serve a cow on account of weakness or pain in the back. In the latter part of June, McGee saw 250 head of cattle crossing his range. They were said to be going into Arizona; they looked like Arkansas cattle.

From McGee's we drove to the place of Robert J. Evans, having heard that he had several sick cattle. He lives about 6 miles east of Kiowa, Barbour County. When we arrived at his place no one was at home, but we found a dead cow lying not over ten rods away from the house; she had the appearance of having died within a few hours. I proposed

to make a *post mortem* examination, even if the owner was absent. We found her resting upon the sternum, the head thrown back to the right side. She was propped up in this way by the nose touching the ground. Cadaveric rigidity had already set in; drops of blood were dried on the hair along the sides of the neck and flanks.

We turned her over on the side and I opened her in the usual way. I found the lower parts of the posterior portion of the lungs in a state of red hepatization, and considerable serous effusion had collected in the thoracic cavity. The endocardium was heavily congested, thickened and discolored; the fleshy pillars in the ventricles were of a dark purple color, and the auricular appendages were extensively ecchymosed. Weight of liver, 20 pounds. Weight of spleen, 4 pounds. The gall-bladder contained one quart of very dark green bile, which was of a granular appearance.

A serous and bloody infiltration was discovered surrounding the kidneys. The urine bladder contained a very dark blood-colored urine; specific gravity 1.012; the organ was thickened by capillary congestion of the mucous coat, and a few ecchymosed spots presented themselves. The contents of the third stomach were very much drier than normal, and the folds presented a congested and irritated appearance; fourth stomach congested, and numerous small erosions and granular elevations were to be seen on the mucous surface. This animal did not present much biliary discoloration of the fat, and the blood was not as thin and watery as is usual in Southern cattle fever. The uterus contained a fetus about four or five months old; it presented a liver enlarged to three times the normal size; the kidneys intensely congested, and partially disorganized by softening and disintegration; spleen nearly normal in color and size; the pericardial, thoracic, and abdominal cavities contained considerable bloody colored effusions of serum. When I was nearly done with the dissection, Mrs. Evans returned, and she told me that the cow had been sick three days. Another cow was sick in the herd; after some lively running we succeeded in lassoing her; she had been sick four days; temperature, 104.5°; pulse, 96; nose dry;ropy saliva flowing from the mouth. October 20th met Mr. Evans, who reported two additional deaths, and two more sick. He brought 116 head of good grade cattle from Allen County, Kansas, arriving on his present range with them on the 11th of May. Since that time the cattle have not strayed in any direction 3 miles distant from a central point on the range. The first loss occurred on the 3rd of October, and 6 have died to date, the 20th.

We next visited Mr. Parsons. He lost some cattle last year, attributed to the bringing in on his range of Indian or Choctaw cattle by Morton and Tolliver. This year he lost 3 out of 80; they died in August. October 20th he reports 2 more deaths. October 23d reports 2 head of the oil-brand cattle, on the same range with his, as being sick. Hink Moore lost 5 out of 700 head. Boyd's cattle ran with his for several weeks before the round-up in July.

We went north from Parson's to Thomas Brakey's ranch. He lives on the Medicine River, in Barbour County, 32 miles southwest from Harper and 3 miles from Kiowa. We remained with him over night.

He came from Chase County, Kansas, last September, with 300 head of fine high grade cattle. In January they were in good condition and thrived well. After a week's sleet and rain in February they began to sicken and die. During the months of February and March he lost 110 head. Some of them died in good condition and most of them retained a good appetite until death. The majority would first show lameness on the left foreleg, would then persist in lying down, and many of them lingered along from two to four weeks before they died. He fed all the corn, sorghum, and millet-hay they could eat. Two of them died in the month of May while on grass. On opening them, after death, the fat presented a very yellow appearance. Mr. Rider also had 400 head of cattle on this same range; he lost 75; they were affected similar to Brakey's.

Mr. Brakey gathered 200 of his cattle in the round-ups in June and July. About the middle of September one cow was taken sick; she died in a few days. Then others sickened; some of them lived five or six days, and others would be found sick in the morning and dead at noon. He took them off the range and turned them into a cane field, but they still continued to die. He lost 15 head.

October 16, visited Harry Matthews, adjoining Mr. Brakey on the north; he has held 36 head of cattle in his fenced range for two years. On the 6th instant 110 head owned by Charles Blackstone, of the Eagle Chief Pool, were turned into Mr. Matthews' field. A few days ago a three-year old steer of Blackstone's was found sick; he died last night.

Post mortem: weight of spleen, 8 pounds; liver, 18½ pounds; heart, 5½ pounds; extensive extravasations of blood into the walls of the right ventricle; bile thick and grumous; urine bladder contained four pints of bloody colored urine; fat the color of yellow bees-wax; third stomach slightly impacted with dry food.

A three-year-old white steer was pointed out to me, which showed evidences of sickness, manifest by segregation, a weak, staggering gait, drooping head, and feces covered with mucus. One of the boys lassoed him. Temperature, 106°; pulse, 90. October 23, 2 more reported sick and the white one dead. I saw Mr. Ewell, secretary of the Eagle Chief Pool, in Harper on the 25th. He stated that no cattle died in their herd this season. Mr. N. Sherlock, of the same pool, corroborated the statement of Mr. Ewell.

From Matthews we drove through a drizzling rain southeast to the line of the Indian Territory; stopped at W. E. Campbell's cow camp. Campbell's pasture is fenced in, located on the Indian Strip, 3 miles wide and 12½ long. The cow-boys told me they lost 6 or 7 out of 3,500 head. They did not show any particular anxiety to be interviewed. We then proceeded to Pryor and Miller's ranch. They own a fenced range in

the territory along the line of Harper and Barbour Counties. The cowboys here reported a loss of 10 out of 500 head of cattle bought from Hink Moore on the 10th of September. Last year they lost on this range 50 or 60 out of 4,000 with Texas fever. Lost last winter 5 per cent. Hold this year 6,000 head. Mr. Lathan, east of W. E. Campbell's, lost 16 out of 500.

We next came to H. Hale's ranch, 23 miles southwest of Harper, in Barbour County. He holds 300 head of cattle. The disease broke out among his herd about the middle of September. He herds his cattle on an open range. Lost 33 out of 300; 20 recovered.

The next place we stopped was at John Peters' camp. He is located on an open range 6 miles south of Mr. Boyd's. He lost, out of 155 head of grown cattle and 100 calves, 84 grown and 12 calves. Three of the calves were only 2 months old; the other 10 were March calves. One animal died in July; the remainder of the deaths occurred during the first fifteen days in September. After 94 had died, he left the herd and went home, stating, so I was told, that they might all go to ———, he was not going to stay any longer to see them die. After a few days he returned, and found 2 more dead; no deaths have occurred since his return to the herd. Let us suppose for a moment that, had he commenced to exhibit medical treatment at the time he left them, and only 2 deaths occurred subsequently, would he not be justified in believing that his treatment had effected the change?

The Peters cattle were mixed up with the Boyd cattle from the middle of April until the 10th of July. A stage road passes across the Peters range, and ox teams frequent this route. From the Peters ranch we drove to Mr. Boyd's and stopped for the night.

On the morning of the 17th Mr. Cochran and I left Mr. Boyd's and went west 3 miles to the residence of David Clough. He gave me the following history: His cattle began to die soon after the 4th of July. He lost 35 head out of 300 during this month; the disease then disappeared. He sold 60 head of his cattle in August. In the early part of September the disease reappeared and he lost 30 head more out of 205. He wintered 150 head; among these the mortality was the greatest. The wintered cattle intermixed, more or less, with the Boyd cattle from the middle of April until they began to die. Two more deaths reported October 21. Mr. Clough and several of his neighbors made a number of *post-mortem* examinations, and he described the appearances of the pathological lesions of southern cattle fever very accurately. Mr. E. C. Davis, 3 miles northwest of Mr. Clough, on the Medicine Lodge stage road, and west of the Illinois colony, states that one of his cows died on the 1st day of July, and that the last death occurred on the 6th instant. The first animal that died had been running with the Boyd herd; the rest of them had been exposed to oxen that Mr. McGuire bought from Boyd in the spring. Loss 6, and 3 recoveries.

The next person we saw was Mr. William Garrison. Garrison, Beals,

and Hufacker hold 600 head of cattle together, on an open range north of the Medicine Lodge stage road, and south of Dr. Wisner's range. The three parties live in the Illinois colony. All of their cattle except 80 head have been in the Sand Creek and Cedar Hill pool. They lost 30 in the month of July. On the 10th of September the disease broke out the second time; they then lost 55 head; 100 that were sick recovered. These same parties held cattle on this range for four successive years, and this is the first year that they met with any loss by disease. Mr. Garrison stated to me that he bought 80 head of vaccinated cattle from the vaccine farm at Webster Grove, Mo., all heifers, yearlings, and two-year-olds, with the exception of 12 head which were yearling steers.

He told me, in answer to my question whether or not the steers had also been vaccinated, "Yes," said he, "they told me they could not always procure a sufficient number of heifers; consequently, had to use young steers." He says he loaded them on the cars at the Old National stock-yards at Saint Louis, and landed them at Harper on the 18th of June. Mr. Garrison reports that the Anderson herd of cattle went as far west as P. B. Cole's range, which is directly north of their range. Mr. White, in the same colony, lost 2 cows and 1 ox out of 4 cows and 6 oxen. He kept them strictly under his care at home. He bought one of the cows in Harper County, and she came over the same road where the McGuire oxen had been traveling. These cattle died in the month of September. Mr. Pelton, in the colony, lost 2 out of 20 head, 1 in July and 1 in September. T. B. Stockstill, on the Medicine Lodge road, between E. C. Davis and M. B. Moore, holds 150 head of cattle.

Two died out of 5 that were sick. The first one was sick on the 6th instant and died on the 9th; the second one died a week later. These cattle were close-herded all summer, and were not in any way exposed to the Boyd cattle. He thinks his cattle took the disease through M. B. Moore's. We then visited M. B. Moore, directly west and adjoining Stockstill. He stated that his cattle began to die on the 11th or 12th of July, and 7 head died during the month. On the 15th of September another outbreak of the disease set in; they then died off rapidly for about ten days, when the death rate began to diminish. Altogether he lost 40 out of 123 head; 5 recovered and 3 are yet sick.

After death drops of blood would be seen to ooze out of the skin between the legs and under the jaw and side of neck. I examined a sick two-year old heifer which he was bringing in from the herd as I drove up. Her temperature was raised to 107.8° F.; she passed feces covered with mucus and blood. I also examined a white cow with calf at her side; had been sick for three weeks; temperature 103.2° F.

His cattle have been close-herded since the 16th day of July. Three of them were cut out of the Boyd herd at the round-up in June; none of the rest have been exposed to Boyd's or any other known diseased cattle, as far as he knows. On the 25th I saw Mr. Moore again, when

he stated that the sick cattle which I had seen at his place were gradually recovering. Mr. McGuire, in the colony, lost 6 out of 60 head of cattle. Mr. McGuire bought two yoke of the Arkansas cattle from Mr. Boyd in the spring.

From Moore's we drove to B. F. Kemp's place, 4 miles south, and west of the Cedar Hill. He made the following statement: Out of 108 head of cattle, 65 got away in August and ranged over the same ground that Boyd's cattle had been grazing on; they remained from the evening until next morning; twenty days after this exposure they began to die; 10 were found sick in one day; they died in from six hours to ten days after they were taken sick; 15 died and 15 recovered. He knows of 4 that died which had been on the infected ground. One calf died, and 1 calf that was sick recovered. He brought his cattle from 10 miles east of Harper, on the 27th day of March; close-herded them all summer. Some of the Boyd cattle came over on his range in June and July. Every one found dead was lying flat on the side. When they got sick they quit eating.

From Kemp's we returned to Boyd's and remained overnight. Next morning, October 18, I took the temperature of the quarantined cattle as recorded in the early part of this report. We then went south to the ranch of Mr. W. E. Mattox. We were there told that he lost 7 out of 125 head of cattle. He brought his cattle on the range in the spring, and they were frequently among the Boyd herd in the early part of the summer. All of the deaths took place during the month of July.

From this place we turned and went north of Mr. Boyd's, 2 miles, to see Mr. James Roberts. He lost 1 cow on the 6th, after a sickness of five days; no others were taken sick. His cattle have been on the Boyd range several times during the summer. Mr. Reeder, who lives 3 miles east of Boyd's, held 27 head of cattle; 3 of them died during the month of July. Next we stopped at Mr. Crawford's, 2 miles west of Inyo post-office. They close-herded 80 head of cattle near home; lost none. They are on a road leading west toward the colony and north to Dr. Wisner's. Crawford, jr., reports having seen a herd of cattle passing between their house and that of Mr. Dougherty, half mile north, early in the season. They were going west.

We then drove to Dr. Henry Wisner's residence, 5 miles northwest of Inyo post-office, in Barbour County. Dr. Wisner was not at home, so I applied to Mrs. Wisner for information. I found Mrs. Wisner to be a regular M. D.; more than that, she took as much interest in the welfare of their stock as her husband did. She superintended a *post-mortem* examination of a bull that died about a week previous, and described the pathological lesions as follows: She found considerable enlargement and engorgement of the radicles and blood-vessels of the liver; the gall-bladder was distended, with a greenish-black bile; spleen very hyperæmic; ecchymosis found throughout the peritoneal sac; urine bladder filled with a highly bloody-colored urine—a deep wine

color; kidneys unusually pale and somewhat enlarged; feces in colon hardened. Dr. Wisner bought in the month of July 120 head of the McMullen cattle on the Botkin range; a number of them died before they were taken home. He took them home in the early part of September, but did not bring them into his inclosed pasture-field among his other cattle until later; 29 of them died before they were placed in the field, and 1 after they were moved in. These cattle were close-herded and kept on poor and dry feed by Mr. Botkin; after Dr. Wisner took them home he fed them on sorghum, millet, and had good pasturage. On an open range, north of the pasture-field where the above mentioned cattle were held, grazed 300 which were being close-herded. Mr. William Garrison, on or about the 20th of July, drove his cattle on to Dr. Wisner's open range; Dr. Wisner drove them back about the 1st of October. Several of the Garrison cattle died while they remained on this range, and were left to decompose near the pools and stream of water where the Wisner cattle had to drink. During the month of October Dr. Wisner lost 1 thoroughbred bull and 2 high-grade calves out of the 300 head. In the month of February Dr. Wisner brought from Waco, Tex., 7 car-loads of Texan cattle, unloaded them at Harper, and then drove them out to his place. These cattle intermixed with his other cattle during the summer. An ox-team, bought from Dr. Wisner's herd of Texan cattle, was employed all summer in hauling hay from Inyo, or near Inyo post-office, to Medicine Lodge. They are owned by Mr. Downing. This hauling was over a distance of from 15 to 18 miles; would probably take three days to make the round trip, and it is the custom of men driving ox-teams to stop any where along the road to feed and to allow their cattle to graze. These cattle passed by Moore's, Stockstill's, Davis', McGuire's, and others living in the colony and along the road to Medicine Lodge. I met the team about 1 mile east of Mr. Davis' house, and received from the driver (an Englishman) the facts as just stated. J. H. Warren, 5 miles northwest of Boyd's, lost 4 out of 40 head of cattle; they died in the month of September. His cattle strayed away and went on the Boyd range several times during the summer. On our way back to Harper we passed Mr. Gardner's place, near the Nine Cottonwoods Creek. Both the Boyd and the Anderson cattle crossed his range. He lost 1 out of 3 cows. Mr. Kepler, 1 mile west from L. M. Pratt, had his cattle staked on and near the Boyd trail all summer; no loss.

We next stopped at L. M. Pratt's, 12 miles west of Harper. He lost 6 cows and 1 bull. The first one was taken sick on the 4th day of July. All died within the space of ten days. He made *post-mortem* examinations of several that died; found the spleen enlarged to three times its normal size; gall-bladder greatly distended with bile; liver enlarged; bloody water in the peritoneal cavity; tallow of a saffron-yellow color; in one the urine bladder was filled with bloody urine, in another it was empty. Many of them passed bloody urine before death. Mr. Boyd

passed one-half mile north of Pratt's house with his cattle on the 9th of April; a few days later brought 20 head of his cattle to Mr. Pratt's house and left them there overnight. Mr. Pratt had 9 bulls and several milch cows at home; these cattle grazed with the 20 head of the Boyd cattle, and also grazed over the trail of the Boyd herd. On the 15th of June Mr. Pratt took 8 of the bulls about 8 miles southwest to his herd, and brought back with him one cow and her calf. This was the first cow to sicken and die. The 8 bulls remained well. On the 23d of June he took to the herd a dry cow and a bull; on or about the 6th of July both these died. No strange cattle, to his knowledge, passed along the range where the cows and bulls grazed except the Boyd cattle. After I obtained the above history from Mr. Pratt I learned that a team of oxen coming from Fort Sill, near Red River, Chickasaw Nation, were driven through by Mr. Pratt's house and remained with him overnight; this was in the month of June. From Pratt's they went west, passed Otega post-office and crossed John Peters's range in Barbour County. It was now getting dark, so we returned to Harper.

October 19, I met Mr. T. A. Barton, who lives in town. He stated that he had his cattle on the range north of the railroad track, but did not lose any. This morning we drove west 6 miles to the residence of Mr. F. P. Melvin; he lost 2 out of 4 head of cattle; one of these died on the 8th of October, and the other on the 17th. I went out into the field to ascertain the *post mortem* conditions of the latter, but found that the dogs had anticipated me; had mutilated the body to such an extent as to render it unfit for further examination. Mrs. Melvin stated: "In the month of August I saw a herd of cattle going west, but I don't know where they came from nor where they went."

We then drove 1 mile further west to C. P. Bradford's. He stated that he lost 5 out of 6 head—2 bulls and 3 cows. Two died in October and 3 in September; 1 recovered. He said: "In skinning them I found the flesh blubbery behind the shoulders; urine bloody before death." This was all he could tell of the symptoms during life and the appearances after death. All of these cattle had been picketed close to the house, and small herds of cattle were frequently driven past his house during the summer. He stated, also, that Mr. Burr's cattle came over among his cattle while they were picketed, and that his cattle had not been within a mile of the Boyd trail at any time during the season.

From Mr. Bradford's we went to Louis Hildebrant's. He stated that Charles Martin had bought 60 or 70 head of cattle from Mr. Potter and had driven them west and southwest of Harper, passing his (Hildebrant's) place on the 6th day of August. Two weeks thereafter Hildebrant lost 3 milch cows out of a herd of 12; they were all taken sick, and 2 that recovered aborted their calves. The Martin cattle were taken to the Botkin herd.

Mr. Welker, 8 miles west of Harper, lives close to the Boyd trail; he settled on this range on the 1st of April. He picketed 6 head of oxen

and 2 cows on the Boyd trail. No loss. We next saw Mr. S. H. Coyer, $1\frac{1}{2}$ miles northeast of L. M. Pratt's. He took 18 cows into the Botkin herd soon after the Boyd cattle passed his place. One of them died on the Botkin range, in July; he then took them home, but they continued to die until 14 out of the 18 head were dead.

We then proceeded towards Silas M. Shafer's place, north of Attica post-office. On the way we met his brother, who told us that Silas lost 10 out of 18 head of cattle; they died in July and September. These cattle crossed the Boyd trail in the spring. On the 1st day of July they were taken into the Botkin herd, and remained there until the middle of the month. In the latter part of April, or beginning of May, a small herd of strange cattle were driven over the same trail that Boyd's cattle passed over. This trail is located a mile south of Shafer's house. Mr. Shafer has resided here for 5 years, and has never before lost any cattle. I saw Mr. Helbert, who lives 2 miles west of Pratt's, at Anthony, on the 1st of November. He stated that he had two cows which followed the Boyd herd on the 9th of April for a distance of 2 miles, and that during the summer they grazed over the Boyd trail, off and on, without any bad results following. We then turned toward Harper, and on the way stopped at Elijah Vian's place, 10 miles southwest of Harper. He lost 36 out of 100 head of cattle during the month of September. Their range was south of the Boyd trail. On the 20th we drove north of Harper to gather the history of an outbreak which had occurred in that locality. We first saw Mr. A. S. Woodward, who resides 3 miles north of Harper. He reported a loss of 14 head of cattle out of 32. These cattle, together with 29 head belonging to D. W. Fye, were herded on the same range all summer, said range being $1\frac{1}{2}$ miles square. One cow belonging to Mr. Carpenter, another to Mr. Creighton, were also kept in this herd; both of them died, and 20 out of the 29 belonging to Mr. Fye died. The disease manifested itself about the 1st of September, and in the space of three weeks' time all of these deaths occurred. Eight in the herd which presented evidences of sickness recovered. They were all good grade native cattle. The history as given me by Mr. Woodward of the symptoms during life, and of the *post-mortem* appearances, leads me to the conclusion that these cattle died with southern cattle fever.

Proceeding from Mr. Woodward's place eastward, 1 mile, to the residence of John Challis, I was there informed by Mr. Challis, jr., that 12 out of 100 head of their cattle died and 6 recovered. Here, also, the disease appeared about the 1st of September. Forty head of these cattle were brought from Doniphan County on the 12th of May, and were driven from the stock-yards at Harper, 4 miles northwest, to Mr. Challis' herd. Two of the Doniphan County cattle died; the other 10 were of the domestic herd. On the 6th of June, 200 head of cattle, said to have been from Memphis, Tenn., were brought into Harper, unloaded at the stock-yards, and driven north 3 miles, where they were

afterward close-herded by Mr. Scoby, the reputed owner. These cattle ranged south and east of the Challis herd and south of Woodward and Fye's herd, a public road being the dividing line between the three herds. I could get no definite history of these cattle. Mr. Cahlan, whose range was southwest of the Scoby cattle, states that 8 or 10 of the Scoby cattle died in the month of September; that the cattle were sold and driven north toward Kingman County; the owner then left Harper. I went to see one of the men who assisted Mr. Scoby in herding the cattle, but could get no satisfactory replies from him, other than that if I had money to pay for information he might tell me what I desired to know; that he was paid by Scoby for the services he rendered him. Some of these cattle were shipped to Kansas City, the remainder were taken northwest by trusty men who would not disclose their destination.

I went to see Mr. William A. Creighton, of Harper. He made the following statement: That he wintered 27 head of cattle. They were in the stock-yards at night with the Boyd cattle, and ranged over the same ground north of the railroad track with them several days. In the latter part of June they were driven out to L. M. Pratt's herd, passing along and over the trail of the Boyd cattle; one of them, a bull, was left at Pratt's for two weeks; he was then also taken to Pratt's herd; he died five days after he entered the herd. None of the rest of the 27 died, although all were equally exposed to the Boyd trail.

October 21, being Sunday, I remained in Harper. At the hotel where I was stopping I met a gentleman from Linn County, who told me that a Mr. Goss, of that county, lost 60 out of 70 head of cattle this summer with Texas fever. I met also Mr. Donahue, of Atchison, Kans., who holds cattle 4 miles east of Caldwell, Sumner County; he lost 2 out of 14 head in the month of September. These cattle he bought from Mr. Cox, who, it is said, lost a large number of cattle this season. Having heard that hog cholera existed at or near Wellington, Sumner County, and as you desired to secure virus for the use of the Department, I therefore took the night train for Wellington. I there made inquiries in regard to the truthfulness of the report, and was referred to the mayor of the city, Mr. Hamilton. He informed me that a fatal disease had prevailed among the hogs on several farms south of town, notably so on that of Mr. John Botkin. I proceeded to Mr. Botkin's place, located one mile south of town, found him at home, and obtained the following history of the disease among his hogs: Mr. Smith, a near neighbor, received some hogs last year from Missouri; soon after he got them home a disease appeared among them and many died; soon thereafter, Mr. Botkin's hogs began to die, and he lost nearly all he had. Those that remained well he sold in the fall, keeping no hogs over winter. The hog pasture of Botkin adjoins that of Mr. Smith. A large pond of surface water is inclosed in Mr. Botkin's pasture, and the surface water from Mr. Smith's pasture flows into this pond. In

the month of June, this year, Botkin bought a number of sows and pigs, took them home and placed them in the same pasture that held his hogs last year. Within a month his hogs began to manifest evidences of disease. As there were none in a dying condition when I saw them, I requested the privilege of killing one for examination. Mr. Botkin willingly granted the request, and caught a 2-months-old boar pig. He presented the following symptoms: pulse, weak and compressible; temperature, 106° F.; considerable swelling across the nasal bones, posterior to the nares; a large ulcer, one inch in diameter, opposite the first molar tooth in the superior maxilla, forming a deep cavity in the tissues covering the alveola; this ulcer was of an unhealthy, foul, and sloughing character. Several small ulcers were present on the tongue, possessing well defined borders, surrounded by a darkened, brownish-red areola; a very offensive odor was emitted from the mouth. Several abscesses and ulcers of variable sizes, from that of a pea to a silver quarter of a dollar were discovered on the abdominal surface, and one large and deep ulcer immediately about the coronet of the right fore foot. (Several other hogs on the place presented similar symptoms to this one, but not so far advanced, the first and most prominent symptom being that of the swelling across the nose, accompanied by more or less snuffling.) They continued to eat, and do not lose flesh very rapidly; a few of them suffer by diarrhea, and colliquative diarrhea sets in before death takes place. (There is no special tendency to hide in the litter, nor is there any roseate blush present at any time during the progress of the disease, as there is in true hog cholera.) I severed the jugular vein and carotid artery on one side of the neck and bled it to death, then removed the wall of the chest and abdomen. I discovered a greenish yellow serum in the abdominal cavity; heart pale and flaccid; lower lobes of lungs in a partial state of hepatization, abscesses and tubercles being distributed throughout the affected parts. The stomach presented two extensive, irregular-shaped ulcers, apparently in process of healing, one of them measuring two inches in length; they were covered with a yellowish deposit of pus, mucus, and feed mixed, which was strongly adherent to the surface of the ulcers. The intestines contained a great number of long worms, *ascaris suillæ*, and the intestinal glands presented a thickened, infiltrated, tuberculous condition. The liver was enlarged to three times the normal size, was of a light olive-yellow color, and numerous small abscesses were found within the structure of the organ; the biliary ducts were literally filled with worms of the same species as were found in the intestinal canal. The worms in the liver obstructed the flow of bile. The gall bladder was filled with bright green-colored bile, thinner and lighter in color than normal. The urine bladder contained three ounces of light green colored urine; kidneys were enlarged, softened, and partially disintegrated, presenting an olive-green color. The fat, and also all of the internal viscera, presented an icteric

appearance. I recommended a change of pasture and water; the hog-pens to be removed and the boards used for some other purpose; the old hog pasture to be plowed up, and seeded with wheat or other grain for at least two years before it should again be used for a hog pasture. I also advised a destruction of all the hogs that indicated plain symptoms of the disease, and afterwards an entire change in the breed or family of hogs. I inclosed in a tin can a portion of the lung, liver, intestine, and stomach of the pig examined, and sent it to your Department by express, for microscopic examination.

After my return to Wellington I saw Mr. Hamilton again, when he told me that he and his partner, Mr. Flint, lost 16 or 17 head of their cattle out of 900 head. Their pasture is fenced in, and is located in the corner of Kingman, Pratt, and Barbour Counties, and comprises 30,000 acres. This pasture held Texan cattle last year. The cattle this year in the field were not exposed to other cattle. The disease appeared in the month of September; 10 or 12 that were sick recovered. Changing pasture and water seemed to offer a check to the disease.

I returned to Harper in the night. On the 23d it rained hard all day, and I remained in town. I saw I. J. Campbell, esq., who gave me the following history: He owns a fenced pasture on the western edge of town. On the 10th day of April Mr. Boyd placed 14 head of lame cattle in this field, which already contained 150 head of natives owned by Mr. Campbell; the Boyd cattle remained for a week or more to recuperate, and were then driven by the way of Pratt's to the Boyd range. Some time during the month of July 2 steers that were brought from the northern part of the county were turned into this field; soon thereafter both sickened and one of them died. The steers in coming to Harper crossed a number of cattle trails. None of Mr. Campbell's cattle died. Mr. R. A. Jones, from Labette County, told me that while on a visit to his brother at Santiago, Cal., last year, his brother told him that cattle that were brought from Old Mexico and driven north into colder and freezing climates in California impart disease to native cattle.

October 24 we drove southwest 16 miles to see Mr. Richard Botkin. He held cattle belonging to Shafer, Coyer, Arnold, Collins, McMullen, and Martin, the total number being 562 head. All of them were native cattle except the McMullen cattle, which were brought from Webster County, Missouri, reaching Botkin's range in the month of May, and remained until the 1st of September. Dr. Wisner took away 120 head of them, and the remainder were sold to and taken away by Mr. Potter. The Boyd cattle passed over his range in April, and all of these cattle have been grazing over their trail. All the deaths in this herd which occurred while on the Botkin range took place between the 2d of July and the middle of August. Loss, 184. Mr. Campbell, at Otega, lost one work ox out of a yoke of oxen in the month of July.

Munger Brothers, of Harper, started from Harper in the month of May 10 thoroughbred and high-grade bulls; by mistake the driver

turned them in with the Boyd cattle, where they remained over night. Seven of these died, and 3 others in the herd of 500, on the Hiak Moore range. They began to die sixteen days after exposure to the Boyd cattle.

October 25, we drove 7 miles west from Harper, stopping first at Mr. H. F. Burr's place. Mr. Burr stated that he shipped into Harper, then drove to his place, four lots of cattle; the first one in the month of March, one in April, one in May, and the last one in June; total number, 450 head. These cattle were brought from Colony, Anderson County, and from Coffee and Allen Counties. Mr. Burr wintered 18 head of cattle. He has been on the same range for five successive years, and has never before lost any cattle. He lost 175 head out of the 468 head this season, and Mr. Moier, his son-in-law, lost on the same range 4 out of 7 head. Mr. Burr thinks that all of his cattle except 25 head had been sick. He used tincture belladonna as a curative agent. Several of his cattle died in the month of July, but the greater number of deaths occurred in the month of September. Mr. Boyd's cattle crossed his range in April. We went out to his herd and I tested the temperature of several, which registered as follows:

	° F.
Two-year-old heifer, has been sick	102.7
One-year-old heifer, has been sick	104.2
One-year-old heifer, has been sick	104.8
One-year-old heifer, has been sick	104.2
Four-year-old bull, has not been sick	102.9
One-year-old heifer, has not been sick	103.4
One-year-old heifer, has not been sick	103.1
Two-year-old heifer, has not been sick	102.9

We then drove 1 mile southwest to A. Hilliard's farm. He lost 1 cow on the 20th of July, and another on the 10th of September. Mr. Boyd's cattle crossed his range half a mile south of the house. On the 18th of June Mr. Anderson's cattle went across the east end of his range, leaving probably 80 rods between the two trails. Hilliard has owned a work ox for the past two years. This ox was picketed on the Boyd trail a number of times during the summer, but remained well. While I was there I noticed a bull corraled near the barn; he appeared thin in flesh, and I inquired if he was sick. Mr. Hilliard replied, not that he was aware of. I tested the temperature of the animal; it registered 102° F.

An eight-year-old cow was in a separate pen; I tried her temperature; it was 101.8° F. On the 30th, as I was going toward Harper in the evening, I met Mr. Hilliard. He stopped me and stated that the eight-year-old cow which I saw in the pen at the time of my visit to his place was sick. "She appeared stupid last night, and this morning yielded no milk." That this cow had positively not been exposed to the Boyd trail, or any other infected place; that she had been kept closely yarded, and had been well fed on dry feed for the past three months. I promised him to see her in the morning. The following morning I drove out

to his place, and found her manifesting the following train of symptoms: Found her lying on the sternum, head well poised; horns warm; nose dry; a dull and drowsy appearance of the eyes; sensible to the flies; pulse depressed; respiration 22; temperature 104° F.; passage of manure slightly covered with mucus, and of a firmer consistency than it should be. I learned that this cow had been turned out to graze with the other cattle on the 29th, and as she had been kept up on dry feed for the past three months I concluded that she had overcharged herself with food to which she was not accustomed, and that this was the cause of her disability. On the 30th she would neither eat nor drink, but was disposed to lie down all the time. When I saw her on the morning of the 31st, she drank half a pail of water, and ate a few ears of corn; therefore I concluded that she must be improving; that she was better the day I saw her than on the day previous. On the 3d of November I again saw Hilliard, in Harper; he reported that the cow had recovered her health.

From Hilliard's we went to Matt. Miller's, 5 miles northwest of Harper. He stated that in the month of July Hugh McClung brought from north of Little Rock, Ark., 65 head of cattle; that he bought 35 head of these cattle from McClung, and placed them with 40 head of his domestic cattle on the same range; he lost 9 head, while McClung, who held the remaining 30 head on a range of Mr. Matthews, lost none. His cattle died during the first and second week of September, after a sickness of from two to five days. Miller sold 30 head of his cattle on the 10th of September.

Messrs. Got and Weaver, of Springfield, Mo., brought into Harper on the 24th of June, 200 head of cattle from Missouri. They drove them out 3 miles northwest, and had them herded on the Matthews range. About the 20th of July deaths among this herd began to occur, and they lost 24 head of their cattle in rapid succession.

October 26, we left Harper for Medicine Lodge, Barbour County, a distance of 35 miles. We arrived toward evening. I saw several cattle-men in town; made the usual inquiries, and was told that many cattle died during this season all over the county; but, when I endeavored to obtain a more definite account as to who the suffering parties were, and the extent of their losses, I could get but little reliable information. I concluded to remain in town over Saturday the 27th, and endeavor to get a more definite history of the outbreak in this part of the county. In the evening I was introduced to Mr. Ebersole, who lives 7 miles west of Medicine Lodge. He told me that on a range next to him 10 had died out of 700 head during the month of September, but that he, himself, had not lost any out of the 50 head which he owned. I also met Mr. Springer, who lives 5 miles southeast of Medicine Lodge. He lost 4 out of 420 head this summer, and 125 out of a herd of 500 last winter. Mr. Springer also stated that his neighbor, Mr. Bullington, lost 12 out of 100 head this season.

On October 27 I went to the office of Mr. T. L. O'Bryan, a live-stock broker. He told me that some emigrants passed through the town of Medicine Lodge, going north, on the 23d or the 26th of May. They were supposed to come by way of Anthony, Harper County, and were going to Colorado. They had with them 4 or 5 ox-teams, with from one to three yoke in a team, and 50 head of loose cattle. They told Mr. Riggs, the sheriff of Barbour County, that they came from Texas, but told Mr. O'Bryan that they were from the Chickasaw Nation, near Red River. Their cattle were in good condition and had the appearance of genuine Texans.

In Mr. O'Bryan's office I entered into conversation with Hon. T. J. Shepler, who told me that in the year 1876, when the through trail for Southern cattle to Dodge City passed along the eastern banks of the Elm River, near Medicine Lodge, 2 head of domestic cows which had been kept in close confinement all summer, were allowed to graze over the trail late in the fall after a fall of 3 inches of snow, and after so late an exposure both cows died. He also told me that a prominent stockman from Montana assured him last spring that cattle coming from the State of Kansas would transmit to their cattle the Texas fever in the most malignant and fatal form. Mr. Shepler thinks the only way to obviate the annual losses among cattle in Kansas by the Southern fever, is to establish a border line of infection and compel the Southern cattle to be slaughtered within the limits of such boundary line.

I then went to see Mr. Frank H. Shelley, secretary of the Salt Forks and Eagle Chief pool. He said:

A number of through cattle, purchased at Caldwell, were located on the Eagle Chief Creek adjoining us on the southeast; some of the Salt Forks cattle drifted on the "T 5" range, belonging to the Texas Land and Kansas City Company; several of our cattle died, but not many; two of them were high-grade bulls. I don't know how many of our cattle were exposed. The pool holds 20,000 head of cattle.

I next met Mr. J. A. McCarty, in the office of the Barbour County *Index*. He is the captain of the Sand Creek and Hackberry pool. He stated that in the month of August, Mr. Lockhart, a member of the pool, brought from Kingman County several hundred head of cattle and placed them in the pool herd. Three weeks thereafter the pool cattle began to die; 15 out of 3,500 head exposed died. It is supposed that several head of Arkansas cattle were among the Lockhart lot. Ten per cent. of their cattle died last winter. I met Mr. William Kelley on the street; he lived 8 miles south of Medicine Lodge. He lost 10 out of 400 head this summer. He does not know in what manner they were exposed. Last winter he lost 50 out of 500 head; they generally became lame in one fore leg; persisted in lying down; would continue in this way from one week to a month before they died. Many of them were valuable cow. They were well sheltered and well fed after they became sick, but the majority of them ultimately died. Several died after the grazing was good in the spring. In 12 or 15 cases that recovered one or both horns came off. Mr. Vanghu, 2½ miles south of Medicine Lodge, brought 60 head of cattle from Kingman County about the 1st

of July. During the month of September he lost 3. Last winter he lost in Kingman County 42 head out of his herd of 300. The best cattle in the herd appeared to be the most susceptible. His cattle were fed on corn in the latter part of the winter. James Wilson, 8 miles south of Medicine Lodge, stated that he gathered one bull at the county round-up which died.

Two other animals died subsequently, and he does not know where these were exposed, except to the bull. Lost last winter 6 per cent. Mr. Hamlin, neighbor to Wilson, lost out of 3 head gathered on the Boyd range, one bull. Mr. B. D. Keyes, on Elm River, 18 miles northwest of Medicine Lodge, reported a loss of 40 head out of 500 last winter. He fed millet, hay, and corn. They were sick from two days to two weeks. Some got lame, and would then lie down nearly all the time; most of them ate well until they died. One cow ate two quarts of soaked corn, then dropped over dead. He further stated that this trouble was almost universal in that part of the county. After skinning the dead cattle he found infiltrations of bloody water under the shoulder blade and foreleg. Mr. B. T. Shields, a neighbor to Keyes, lost this summer 16 out of 225 head.

On October 28th we left Medicine Lodge and drove west toward Lake City; the first place at which we stopped was Henry Morehead's, 3 miles west of Medicine Lodge. He told me that he had 144 head of cattle in a herd, under the care of P. B. Cole, on Antelope Flat, northwest and north of the Illinois colony. Also, that his neighbor, Mr. Updegraf, had 60 or 70 head in the same herd; neither of them had suffered any losses. The next place on our way to Lake City at which we stopped was Mr. Sanderson's, who lives on the north side of the Medicine River, 8 miles west of Medicine Lodge. He lost 3 head of cattle out of 40 in this month. Cause of death, or manner of infection, not known. He told me that Mr. Robert Ingram, on Cedar Creek, 7 miles west of Medicine Lodge, lost 6 out of 50 head during this month. Manner of exposure not known. We then proceeded to Lake City, which is 18 miles northwest of Medicine Lodge, and from there we drove 2 miles north, to Mr. W. F. Gordon's ranch. Mr. Gordon holds 400 head of cattle on a 7,000-acre fenced range. This range is supplied with water from several clear-water springs, all of which head within the inclosed range. Mr. Gordon lost 35 head of cattle. The first one died on or about the 25th of September, and the last one on the 25th instant. Ten or 12 that were sick recovered. Mr. Gordon knows of no way in which his cattle were exposed, only that once or twice the gate at the north end of the field was left open by persons passing through, and a few of his cattle got out, but were always returned within a few hours. One hundred and eighty-nine head of these cattle were bought from Renben Lake, of Lake City, on the 1st of July. They were Arkansas cattle, wintered by Mr. Lake in a fenced field adjoining that of Mr. Gordon. The balance of Gordon's cattle, 212 head, were double

wintered in his field. As I was anxious to make a *post-mortem* examination in order to discover the exact nature of the disease, I went out late in the evening to see the condition of the heifer which died on the 25th, three days ago. She was badly bloated. I opened her in the usual manner, and found that the internal viscera were undergoing decomposition, and were scarcely fit to handle. I removed the spleen, which weighed 4 pounds. The liver was enlarged. A bloody-colored fluid was contained in the pericardial sac; also bloody-colored urine in the bladder. The fourth stomach presented the characteristic erosions and gastric redness of southern cattle fever. Mr. Gordon stated that in 1858 he lived in the State of Missouri, on the through cattle trail. The trail led around a corner of his pasture field, the corner not being quite square; late in the fall he built the fence out so as to form a square corner; by so doing he inclosed a part of the trail. The cattle which were in the field soon began to die after the moving of the fence, and continued to die until some time in the month of January; 50 out of 100 head died.

We remained over night with Mr. Gordon, and next morning returned to Medicine Lodge. As we passed Mr. Morehead's place his wife came out to the road and told me that her husband had found the day before a sick heifer among his cattle on the Cole range; that he had started her toward home, but she dropped down near Elm River, and was unable to rise, and that he desired me to see the animal. I was directed where to find it, and I complied with their wishes; I found the heifer dead. I saw the animal at 2 o'clock on the 29th, and Mr. Morehead had found her sick at about the same time the day previous. She appeared to me as if death had taken place in the night or early morning; was badly bloated; a few small balls of feces, covered with dried blood, and mucus, were lying behind her. The mucous membrane of the rectum appeared inflamed, swollen, and protruded several inches from the anus. I opened her on the right side, following the usual custom. Decomposition had taken place to a much greater extent than any that I had ever examined after so short a period after death.

The blood-vessels contained more blood, and of a better quality than is usually found after death from southern cattle fever. The animal was exceedingly fat, and the fat was of a very high yellow color, very nearly a chrome yellow. All of the internal viscera were, more or less, distended by gasses. The pericardium contained 10 or 12 ounces of bloody-colored serum. In the arterial side of the heart I found a very extensive and strongly organized fibrinous clot, extending through the valves, and into the aorta for at least 8 inches. The spleen weighed $3\frac{1}{2}$ pounds, and blood extravasations were found under the peritoneal covering. The liver was enlarged, and filled with blood, and enormously distended by gasses. Erosions and subacute congestion of the lining membrane of the fourth stomach were present. The urine bladder contained a few ounces of bloody-colored urine. The kidneys were almost completely disorganized by the ravages of active decomposition.

At Medicine Lodge I saw Mr. Standiford, of the cattle firm of Standiford, Youmans & Co. Their range is located 6 miles southeast of Medicine Lodge, between the Medicine River and Cedar Hills. He made the following statement:

About 150 head of cattle, coming from near Wichita, Sedgwick County, were driven along south on the divide between Antelope Flat and Elm Creek, and were brought to and camped on the center of our range one night. As near as I remember the date it was about the middle of June. I went out to see the cattle; they looked very suspicious. Mr. Shanstrom, who was with the cattle, told me that the cattle came from Arkansas; that he bought them in February, and shipped them into Wichita about the 1st of April; that they were kept on rough feed, and afterward herded on the Ninnescah River until they were started South. Several well-bred bulls, which were bought at Wichita, were among the herd, but a large proportion of the herd looked bad. From my place they went southwest 100 miles to the Cimarron River, and were placed with some other cattle which were in a small pool formed by Blackstone, Tucker, Mills, Conner, and Shanstrom.

About one week after Shanstrom's cattle left my place Mr. Tucker (of the above-mentioned pool) came to my place and told me that the Arkansas cattle which Shanstrom took down were dying off rapidly; also, that some of the other cattle in the pool were dying. On the range where these cattle camped one night we have 700 head; they have been close ranged in the spring and summer, but several of them drifted away; afterward 3 were gathered on the Boyd range at the time of county round-up. Two weeks after the Shanstrom cattle were on our range one of ours died; soon another one; the second one was gathered on the Boyd range. Texan cows which had been double wintered, and had also been exposed to the Boyd cattle, remained well. One bull died that I kept up and stall-fed all winter, which I know had no chance for exposure to the Boyd cattle, nor did he stray away from our herd. He died in the first week of October. Another bull which had been kept exactly like the first one died on the 25th. One cow that I kept in town until the last of June and then took her to the herd, where she was kept within sight every day, also died. Altogether we lost ten of the very choicest cattle in the herd. Last winter we lost 10 per cent. of our domestic cattle, and 6 per cent. of the Texan cattle.

I met Mr. A. L. Duncan, of Medicine Lodge, who told me that three different herds of cattle passed through their place in the latter part of May and early June. One of the outfits told him they were from Red River, Chickasaw Nation, and said they were going into Colorado. The second outfit were going to Montana, and the third into Utah. The three herds numbered about 500 head of cattle, and looked like Indian or Northern Texans. From Medicine Lodge they passed in a westerly direction toward Fort Dodge.

While at Medicine Lodge I met Mr. P. B. Cole. He lives 2 miles west from Dr. Wisner and north of T. B. Stockstill. He owned 250 head of cattle, and held 150 belonging to other parties. These cattle were nearly all gathered in the county round-up on Antelope Flat, between the 1st and 15th of July, where they had been with several hundred other cattle. In this round-up 25 or 30 stray cattle were found for which no owners appeared. The Anderson herd of cattle grazed on the Cole range for several days in the latter part of June. Mr. Cole lost out of his herd of 400 25 head—2 in July and 23 in September. William Dark, north of Cole's, lost 16 out of 350 head of cattle during the month of September.

The first place at which we stopped, after leaving Medicine Lodge, on October 30, was the Hulitt, or open A range, on Camp Creek, Harper County. Hulitt Brothers brought 250 head of good high-grade cattle on the range from Iowa a year ago, which have remained on the same range up to this time. Mr. Miller, of Washington County, Iowa, unloaded at Harper, on the 9th of April, 220 head of Iowa cattle, kept them on the range north of the stock-yards and in the yards at night for three successive days, then drove them out on the range occupied by Hulitt Brothers, and placed them under their care. Mr. Ament, of Anthony, Harper County, shipped from Coffeyville, Mo., and unloaded at Harper 300 head of cattle; they arrived at Harper on the 28th of June. He then drove them southeast into the eastern part of the county on a school section, and herded them there until the 10th of July. They were then taken west and placed on the Hulitt Brothers range, arriving on the 12th. One of these cattle died on the same day that it arrived upon the range, and others of the Ament cattle died daily thereafter, until the number of deaths reached 47. None of the Miller nor of the Hulitt Brothers cattle died.

The last death among the Ament cattle occurred on the 1st of October. This was a black bull, bought in Kansas for \$540. Forty head which had been sick recovered. The sick were treated by giving one quart of raw linseed oil at a dose, and by using the same by injection into the rectum. Some recovered after passing bloody urine. The Boyd herd of cattle ranged over this ground in the early part of the summer, and 3 head of them were with the Hulitt Brothers cattle later in the season, 1 remaining six weeks.

The Miller cattle, which were unloaded at Harper on the 9th of April, were with 20 head of the crippled Boyd cattle in the yards and on the range north of the yards, and ate corn, cane, and millet-hay from the same piles. The description of the *post mortem* appearances in the Ament cattle, as given me by Mr. Hulitt, convinces me that they died with the southern cattle fever.

We next stopped at Attica post-office, Harper County. There I saw Mr. G. W. Markham, who stated :

One of my two-year-old steers got among the Boyd herd as they were passing along north of my range on the 10th of April. I followed him and brought him back home the same evening. Two days thereafter I sold him to H. D. Drumm, of Kiowa, who has since told me that the steer died.

Mr. Drumm had 2 head of the Boyd cattle among his herd from the latter part of April until the 1st of July, but did not lose any of his cattle except the one bought from Mr. Markham. At Attica I was told that a yoke of oxen had been staked on the Boyd trail, south of Gardner's; they were used for breaking sod, and remained there all summer. No sickness followed the exposure. In the evening I met Mr. J. C. Fox, of Seymour, Iowa, at the Glenn House, Harper. He told me that he brought four car loads of cattle into Harper on the 12th of April. He

held his cattle in the yards at night and on the range north four or five days, 1 of the Boyd cattle being with them all this time. These cattle were taken northwest 18 miles, on a range, and remained there until the 20th of August. No loss or sickness appeared in this herd. Mr. Hardwick, of the Glenn House, told me that he had a sick cow, also that he lost one several days ago. I promised to go out in the morning to see her.

On the 31st I drove out 2 miles west to Mr. Forrey's inclosed pasture field to see the Hardwick cow. I found the cow in the following condition at 9.30 a. m.: Temperature 106°; lying on the left side with head thrown somewhat to the right; was apparently suffering great pain, as was manifested by her deep and agonizing groans; eyes prominent; left horn much colder than the right; nose dry; skin a deep yellow color; pulse 86; respiration 20; painful and prolonged expirations; could feel through the abdominal walls posterior to the ribs decided enlargement of the liver; auscultation and percussion revealed no lung trouble; thick viscid saliva stringing from the mouth—not profuse. At 10.15 the temperature was 97.5°. At 10.30 I introduced the instrument into the bladder, where it registered 97.4°. I cut a deep gash into the tail, 1 inch in length, about 4 inches below the root, in order to observe the flow and the color of the blood, but only a few drops oozed from the incision; it was very thin and watery. I cut another gash into the fleshy part of the thigh, but only a slight trickling of blood followed. In making these incisions the animal evinced no pain. At 11 o'clock she made an effort to get up, but failed. A sweat now broke out on the nose; pulse very tense, yet weak. As I stood by her side I could hear distinctly each heart beat. It appeared as if nature was concentrating all the strength that was within the animal to maintain the heart's action. She is now resting on the sternum, with head extended, the lower jaw resting on the ground, and groans at each expiration of breath, to which it is painful to listen. Tremors of the vasti muscles, and also of the muscles of the neck, now appeared. At 11.15 temperature 98°. I then left her; returned again at 2 p. m., and found her dead. The surface of the body was yet warm, and out of curiosity I inserted the thermometer into the rectum, when it registered 103.5° F. An hour later I returned prepared to make a *post mortem* examination. There were present at the examination Messrs. Ewell, Cochran, and Ross, of Harper.

The animal was lying on the left side, and a quart or more of a greenish watery fluid had escaped from the mouth and nose. After exposing the internal organs to view I found the lungs slightly emphysematous and a frothy spnta in the capillary tubes; pericardium contained about 6 or 8 ounces of dark, bloody-colored fluid; external surface of heart extensively ecchymosed; in fact, looked limp, bruised, and worn out by sheer exhaustion; the internal surface of the heart was almost black, caused by capillary congestion and extravasation of blood into the endocardium; no blood clots in the heart. The heart weighed 5 pounds. The spleen weighed 4 pounds, and presented a disintegration

of the glandular structure; the external surface presented numerous ecchymosed spots, and a purple and gray-mottled appearance. The liver weighed 15 pounds, and possessed a spongy feel to the touch; was darker in color than normal, and manifested fatty degeneration. The gall bladder contained 30 ounces of thick, granular appearing bile, of a greenish-brown color. The third stomach presented nothing abnormal, but the fourth presented the characteristic redness and erosions, exposing the vascular membrane, indicative of southern cattle fever. Surrounding the kidneys was discovered a yellowish gelatinous infiltration. The kidneys were darker than normal, and contained bloody-colored urine in the ducts and tubuli. The uterus contained a six-weeks' old fetus; this organ presented no marked lesions. The urine bladder was distended with 2 gallons of a dark, almost brown, colored urine; specific gravity 1.012. The blood in the blood vessels was not so thin as is usual in such cases, but was deficient in quantity. Mr. Hardwick bought these two cows, together with 48 other cattle, on or about the 10th instant, from Mr. Bailey, who lives 2 or 3 miles northwest of town. The 48 head were taken down into the Indian Territory on the 16th—the same day the two cows were placed into the Forrey field. All of these cattle crossed several cattle trails before they reached the Forrey pasture. This day I saw Mr. L. C. Bidwell, of Anthony. He owns 2,000 head of cattle, which are pastured in an inclosed field containing 12,000 acres, located in the Indian Territory, along the south line of Harper County.

He stated that cattle had been dying all around his pasture, but that he did not lose a single one. Mr. J. W. Walcott, of Harper, kept 11 cows from which he supplied milk to the citizens of Harper. He herded them north of the railroad track. The first loss occurred on the 4th day of July, after six days' sickness; 10 head died before the 1st of August. The remaining one was sick three or four days, then began to improve, and in a week was again apparently well. Mr. R. J. Jones picketed his cow north of the railroad track for the space of a week in the early part of July; no sickness followed. He has owned the cow for four years. John Elrod, of Harper, owned 8 head of work oxen, all of them wintered cattle. One of them was a Texan, eight or ten years old, and had been owned in the county several years. These cattle were pastured north of the railroad at Harper for a month before any disease appeared among any of the cattle in or around Harper. In the month of October 4 out of the 8 oxen died, the old Texan being the last one to succumb to the disease.

On November 1 we drove to Anthony, 9 miles south of Harper, principally for the purpose of seeing Mr. Ament, who suffered such a heavy loss on the Hulitt range; but we failed to find him at home. Here I made inquiries relating to disease among cattle, and was told no cattle in that immediate locality died this year. Mr. Northup, a prominent cattle man of Anthony, told me that nearly all the domestic cows along

the trail of the Anderson cattle died. The Anderson cattle passed 6 miles west of Anthony on their way south to the Territory line. He also told me that Mr. Singer, 10 miles east of Anthony, lost a large percentage of his cattle last winter; they are said to have been in good condition and were well fed. They had been brought from Iowa and Northern Missouri in the fall. After returning to Harper I traced up the town cows that died in Harper as follows:

Owners.	Number of cows lost.	Value.
J. M. Bloom.....	2	\$70
John Grimes.....	1	40
C. Arthur.....	2	75
R. Gorman.....	1	40
Mr. Schwenk.....	1	35
P. P. Thomas.....	1	36
E. Keefer.....	1	35
George Cook.....	1	35
John Hyatt.....	2	80
M. Cochran.....	2	90
B. Orange.....	1	40
J. Burd.....	1	35
Mr. Cyphers.....	1	38
S. Keever.....	1	46
Total.....	18	695

All of these cows grazed north of the railroad track. The town cows which were not allowed to graze north of the track escaped the disease.

HISTORY OF THE ANDERSON CATTLE.

Six car-loads of cattle shipped from Springfield, Mo., in the name of the Bank of Springfield, and consigned to Mr. Anderson, were unloaded at Harper on the 6th day of June. These cattle remained at the stock-yards about ten days, ranging northeast of the yards during the day. They were then taken out west about 4 miles, southwest until they reached the Medicine Lodge road, followed this road into Barbour County, through the Illinois colony, and rested upon the range of P. B. Cole a week or more. They then were driven back again by way of Inyo post-office, thence by Joppa post-office, passing over W. E. Kline's range 5 miles west of Attica post-office, then in a southeasterly direction toward Anthony, but leaving Anthony 6 miles to the east, then south to the line of the Indian Territory, then east along the line to Gilmore's range, 6 miles west of Caldwell, in the Indian Territory. Seventy-eight head of these cattle were sold before they left Harper to a Mr. Smalley, in the southwest corner of Kingman County, and were driven by him in a direct course northwest from Harper to Kingman County, Mr. Anderson stated that these were Arkansas cattle. Mr. Cochran stated that he bought conditionally 100 head of cattle in White County, Arkansas, last winter, but that Mr. Anderson afterward saw the same lot of cattle, and by offering more for them closed a bargain, and drove them to Springfield, Mo.

On November 2, we drove out to see Mr. Potter, but he not being at home his son gave me the following information: They held cattle 12 miles northwest of Harper; they bought 131 head of cattle out of the McMullen herd on the Botkin range; afterward added 106 head of domestic cattle brought from the line of Kingman County. Two native milch cows were also turned in with this herd. Out of the first herd (131) 32 died; out of the 106 head 26 died. All of these, excepting 4 head, died previous to the 10th of August—the 4 died in September, and 10 that were taken sick in September recovered. The first lot of cattle were bought on the 1st of July, and were taken on the range on the 8th; the second lot were bought a few days later. The McMullen cattle began to die on the 8th of July. Mr. Potter knows of no other cattle dying near their range.

Clotfelter and Thomas have a fenced pasture, 6 miles square, in Kingman and Harper Counties. This field contained cattle belonging to Clotfelter and Thomas, 300 head; Aaron Canalt, 160 head; Mr. Blake, 300 head; Harroldson and Sheldon, 700 head. All of these cattle, except 640 head of Harroldson and Sheldon's, were wintered in this field, and during the winter 150 head died, the loss being attributed to insufficient food and water, and want of shelter. Harroldson and Sheldon placed into this field, in the month of June, 700 head of cattle, said to have been brought from Missouri; Munger Brothers put in 400 head after the disease broke out, and allowed them to remain until the 1st of October. In the month of July disease appeared among cattle in this field, and Harroldson and Sheldon lost 30 head. They removed their cattle early in September. The loss among Blake's cattle I could not ascertain. Clotfelter and Thomas lost 3 head; Munger Brothers, 16. No other cattle adjoining this field died, except a few in Flint & Hamilton's field, located in the corner of Kingman, Pratt, and Barbour Counties.

William Nance, 15 miles northwest of Harper, bought 3 steers out of the Boyd herd in the spring, took them home, and picketed them near his house. After the steers were removed a cow was picketed on the same ground; in about two weeks she became sick and died. Soon afterward Mr. Nance bought two cows, picketed them on the same place; both of them became sick, and one died. The steers remained well. This completes my investigation of cattle disease in the counties of Harper and Barbour.

List of herds of cattle suspected of conveying the disease.—No. 1, the Boyd cattle, arrived at Harper April 6; No. 2, the Anderson cattle, arrived at Harper June 6; No. 3, the Scoby cattle, arrived at Harper June 6; No. 4, the McClung cattle, arrived at Harper July; No. 5, Arkansas cattle, which crossed McGee's range in June; No. 6, three emigrant herds through Medicine Lodge June 1; No. 7, Shanstrom cattle, June 1; No. 8, Garrison cattle, arrived at Harper June 18; No. 9,

county round-up, in Barbour, July 1 to 15; No. 10, Territory round-up, in Barbour County, June and July; No. 11, emigrants which passed by Pratt's in June; No. 12, the Wisner oxen, *including the Downing yoke*, arrived at Harper in February; No. 13, Martin cattle, from Mr. Potter, October 6.

It may be said that all of these herds rest under greater or less suspicion; but, owing to the limited time allotted to me for my investigations, I have not been able to establish the fact that any of them were capable of communicating disease to other cattle, directly or indirectly.

The following summary may be readily understood:

Owner.	Exposed to herds number—	Number of cattle exposed.	Number sick.	Number of deaths.	Number of recoveries.	Date of outbreak.	Value.	County.
Dr. Joseph Brockway.	1, 11	75	28	23	5	July 10, Sept. 12.	\$575	Harper.
E. Walden	1, 2	7	7	7	.....	Sept.	275	Do.
William A. Wood	1, 2	13	5	1	4	Oct. 12	30	Do.
Jesse Boyd	8, 9, 10, 12	680	16	16	.....	July 10, Sept.	320	Barbour.
R. B. McGee	5, 9, 10	200	29	21	8	Sept. 15	630	Do.
W. W. Cook	1, 5, 7, 9, 11, 12	331	90	75	15	July 9, Aug. 29.	2, 900	Do.
A. B. Ranalls	1, 5, 7, 9, 11, 12	150	30	30	.....	Sept.	900	Do.
John Elmore	1, 5, 9, 10, 11	250	156	156	.....	July 1, Sept. 1	4, 680	Do.
R. J. Evans	.....	116	10	6	4	Oct. 3	300	Do.
Mr. Parsons	5, 6, 9, 10	80	5	5	.....	Aug., Oct. 20.	200	.....
Hink Moore	5, 6, 9, 10	709	5	5	.....	.....	150	Do.
Thomas Brakey	5, 6, 9, 10	200	15	15	.....	Sept. 15	600	Do.
C. Blackstone	.....	110	4	2	.....	Oct. 12	80	Do.
W. E. Campbell	Fenced	3, 500	7	7	.....	.....	210	Do.
Tryor & Miller	do	500	10	10	.....	Sept. 10	300	Indian Ter- ritory.
Mr. Latham	do	500	16	16	.....	.....	480	Barbour.
H. Hale	1, 5, 6, 9, 10	300	53	33	20	Sept. 15	990	Do.
John Peters	1, 9, 10, 11	255	136	96	40	July, Sept. 1	2, 280	Do.
David Clough	1, 8, 9, 12	300	77	67	10	July 4, Sept. 1 to 10	2, 450	Do.
E. C. Davis	1, 2, 8, 9, 12	60	9	6	3	July 1	236	Do.
William Garrison	1, 2, 8, 9, 12	600	185	85	100	July, Sept. 10.	2, 250	Do.
Mr. White	1, 2, 8, 10, 12	10	3	3	.....	Sept.	120	Do.
Mr. Pelton	1, 2, 8, 9, 12	20	2	2	.....	July, Sept.	70	Do.
T. B. Stockstill	1, 2, 8, 12	150	5	2	3	Oct. 6	90	Do.
M. B. Moore	1, 2, 8, 9, 12	123	48	40	8	July 11, Sept. 15.	2, 000	Do.
M. McGuire	1, 2, 8, 9, 12	60	6	6	.....	.....	240	Do.
B. F. Kemp	1, 5, 6, 11, 12	108	30	15	15	Aug.	480	Do.
W. E. Mattox	1, 9, 10	125	7	7	.....	July	245	Do.
James Roberts	1, 2, 8, 12	17	1	1	.....	Oct. 6	20	Do.
Mr. Reeder	1, 9, 10	27	3	3	.....	July	100	Harper.
W. H. Wisner	{ 1, 2, 11, 12, 13	123	30	30	.....	Sept.	600	Barbour.
J. H. Warren	{ 7, 8, 12	300	3	3	.....	Oct.	500	Do.
Mr. Gardner	{ 1, 2, 8, 12	40	4	4	.....	Sept.	160	Do.
L. M. Pratt	1, 2, 11	3	1	1	.....	.....	40	Harper.
F. P. Melvin	1, 11	15	7	7	.....	July 4	340	Do.
C. P. Bradford	1, 2, 11, 13	4	2	2	.....	Oct. 8	84	Harper.
Louis Hildebrandt	.....	6	6	5	1	Oct.	205	Do.
S. H. Coyer	13	10	10	3	7	Aug. 20	120	Do.
S. M. Shafer	1, 2, 11	18	14	14	.....	July, Sept.	560	Do.
E. Vian	1, 2, 11	18	10	10	.....	July, Sept.	300	Do.
A. T. Woodward	1, 11, 13	100	36	36	.....	Sept.	1, 260	Do.
John Challis	3	56	44	36	8	Sept. 1	1, 270	Do.
Mr. Seoby	3	100	18	12	6	Sept. 1	400	Do.
W. A. Creighton	1, 2, 4, 8, 12, 13	200	10	10	.....	.....	250	Do.
T. Goss	1, 11	27	1	1	.....	July	200	Do.
Mr. Donahue	.....	70	60	60	.....	.....	1, 800	Linn.
Flint & Hamilton	.....	14	2	2	.....	Sept.	70	Sumner.
	.....	900	29	17	12	Sept.	950	Kingman, Pratt and Barbour.
R. Botkin's herd	1, 2, 11	562	184	184	.....	July 2	5, 520	Harper.
Mr. Campbell	2, 5, 11	2	1	1	.....	July	50	Do.
Munger Brothers	1, 2, 5	510	10	10	.....	May or June	750	Barbour.
H. F. Burr	1, 2, 13, 12	475	450	179	271	Sept.	3, 495	Harper.

Owner.	Exposed to herds number—	Number of cattle exposed.	Number sick.	Number of deaths.	Number of recoveries.	Date of outbreak.	Value.	County.
A. Hilliard	1, 2	5	2	2	.....	July, Sept ..	\$80	Harper.
Matt Miller	4	75	9	9	.....	Sept.	200	Do.
Got & Weaver	1, 2, 3, 8, 12	200	24	24	.....	July 20.	600	Do.
Ehersole's report		700	10	10	.....	Sept.	300	Barbour.
Mr. Springer		420	4	4	.....	.....	125	Do.
Mr. Vaughan	6, 7	60	3	3	.....	Sept.	75	Do.
Mr. Bullington		100	12	12	.....	.....	400	Do.
Salt Forkes and Eagle- chief pool.	(*)	20, 000	.....	several	.....	.....	.....	Do.
Land Creek and Hack- berry pool.		3, 500	.....	15	.....	.....	500	Do.
William Kelley	5, 6, 7	400	10	10	.....	Sept.	300	Do.
James Wilson	6, 7, 9	550	3	3	.....	.....	150	Do.
Mr. Hamlin	1, 6, 9, 12	3	1	1	.....	.....	160	Do.
B. F. Shields		225	16	16	.....	.....	500	Do.
Mr. Sanderson		40	3	3	.....	Oct.	120	Do.
Robert Ingram		50	6	6	.....	Oct.	210	Do.
W. F. Gordon		400	47	35	12	Sept. 25.	1, 555	Do.
H. Morehead	2, 8, 12, 9	144	1	1	.....	Oct. 29.	30	Do.
Standiford & Co	1, 5, 6, 7, 9	700	10	10	.....	July, Oct.	520	Do.
P. B. Cole	1, 2, 7, 8, 9, 12	400	25	25	.....	July, Sept.	1, 000	Do.
William Dark	1, 2, 7, 8, 9, 12	350	16	16	.....	Sept.	480	Do.
Mr. Ament	1, 2, 3, 8	300	87	47	40	July 12.	2, 081	Harper.
"Markham steer"		1	1	1	.....	.....	30	Do.
Mr. Hardwick	(†)	48	2	2	.....	Oct. 28.	80	Do.
J. W. Walcott	(‡)	11	11	10	1	July 4.	500	Do.
John Elrod		8	4	4	.....	Oct.	200	Do.
Town cows, Harper		18	18	18	.....	July 4.	695	Do.
Potter & Son	1, 2, 3, 8, 12	239	68	58	10	July 8.	1, 160	Do.
Clofelter & Thomas		1, 560	49	49	.....	July.	1, 470	Kingman and Har- per.
William Nance		3	2	2	1	July.	80	Harper.
Total		19, 229	2, 272	1, 768	604		\$53, 756	

* Supposed Arkansas cattle.

† All of the trails at the west edge of Harper.

‡ All north of the railroad at Harper.

It will be safe to say that 2,000 head of cattle died this year, in Harper and Barbour Counties, with the southern cattle fever, and that the direct and indirect loss will not fall short of \$75,400.

GLANDERS AMONG HORSES.

Before leaving Harper, I went northeast 11 miles to the residence of Mr. Alexander Cheesman, to investigate the nature of a disease among horses, supposed to be glanders. After arriving at the place, Mr. Cheesman led the affected horses out of the stable. The first one I examined was a ten-year-old horse belonging to Joseph Cheesman. This horse had a discharge from both nostrils, of a greenish-yellow color; considerable tumefaction across the external surface of the nasal bones; dullness upon percussion was manifest over the maxillary sinuses; numerous ulcers of various sizes were visible upon the nasal septum, chancre-like, and of a dirty yellowish color, with elevated serrated borders; milliary tubercles appeared in clusters on the schneiderian membrane, extending as far up in the nasal cavity as I could see. Both the submaxillary lymphatic glands were enlarged, hard, and nodular to the sense of touch, but not strongly adherent to adjacent structures. An abscess was in process of formation on the lower surface of the chest, one on the inside of the right hind leg, another one on the molar bone, and one on

the left temporal bone—veritable farcy buds. On percussion, dullness was manifest over the inferior lobe of the left lung; respiration was accelerated. There was also a discharge of thick viscid matter from the left eye, and swelling and partial protrusion of the membrane nictitans. I was told that this horse had been coughing, more or less, for a year.

The next one which was led out for examination was a six-year-old bay mare, also belonging to Joseph Cheesman. She had a discharge from the right nostril, which was of a very gluey character, adhering around the margin of the nares, numerous small characteristic glanders ulcers on the septum nasi, and enlargement of the submaxillary lymphatic glands on the corresponding side. Both hind legs were edematous and presented swelling and tumors along the lymphatics, extending from the hock upwards to the inguinal region; the inguinal glands also were enlarged, hard, and sensitive to touch.

The third animal examined was a gray horse, fifteen years of age, belonging to Alexander Cheesman. He had a discharge from the left nostril; a hard swelling—the size of a walnut—of the left submaxillary lymphatics; a few small circumscribed tumors distributed over the surface of the body—farcy buds. This horse presented no visible nasal ulcerations. I examined two other horses, which have been in the same stable with the affected ones, but could discover no evidence of disease in either of them. Mr. A. Cheesman told me that a four-year-old mule died in the same stable in the month of March, and that she presented symptoms similar to the first horse that I examined. I pronounced the three horses to be affected with glanders and urged the owners to have them destroyed; but they did not promise to follow my advice, unless they could get some recompense from the county or State. On the 10th of November I addressed a letter to Hon. G. W. Glick, governor of the State of Kansas, stating to him how I found those horses affected, and requesting him (in the absence of a State board of health) to take the matter in hand if he had any authority to order the destruction of such diseased animals. In reply I received from him the following answer:

I have no authority under the laws of this State to do anything in relation to the diseased horses of which you write, but I shall call the attention of the county attorney to the matter and see whether he can do anything by communicating with the parties to induce them to kill their diseased stock.

HOG CHOLERA, OR SWINE PLAGUE.

Having heard that hog cholera proved very fatal to hogs in the vicinity of Mulvane, Sumner County, Kansas, I left Harper on the morning of the 5th and arrived at Mulvane in the evening. There I saw Mr. E. F. Osborn. He informed me that Mr. Rucker, Mr. Kennedy, and Mr. Smith had suffered heavy losses this year by the death of their hogs. Next morning I saw Mr. A. A. Rucker, who resides three-quarters of

a mile south of Mulvane. He told me that a year ago a number of hogs were shipped into Mulvane, coming from the State of Iowa. Several of them broke out of the yards and had the run of the town for several days. They got in with some hogs belonging to Mr. Hill, of Mulvane; soon afterward Mr. Hill's hogs began to sicken and to die. Mr. Rucker's hogs escaped from their pasturage and got in with Hill's hogs, rooted around, and probably ate of some of the dead; in seven or eight days Mr. Rucker's hogs became sick, and many of them died—he lost 25 per cent. Ten females recovered, and were kept until this spring, but failed to breed. Last spring Mr. Rucker bought 110 head of hogs from his neighbors, and placed them on the same grounds where the hogs had died the year previous. In the month of June they began to die; and this time he lost, including small pigs and shoats, 150 head. Ten of them were large, fat hogs. Estimate of loss, \$800. I then saw Mr. E. A. Kennedy, who lives 3 miles south of Mulvane. He lost this year 150 out of 350 head of hogs, 50 of them being large heavy animals. Estimate of value, \$1,000. Mr. Smith, a neighbor to Kennedy, also lost a large number of hogs this year. All the hogs in these three different herds have been indirectly exposed to the imported hogs, or to each other. From the description of the symptoms of the disease, as given me by Messrs. Rucker and Kennedy, I conclude that the disease has been true hog cholera; but none were sick or recently died, therefore no opportunity was afforded me to establish the nature of the disease positively.

OUTBREAK OF SOUTHERN CATTLE FEVER IN BUTLER COUNTY, KANSAS.

In your instructions of the 9th of October, you referred me to Senator P. B. Plumb, of Emporia, for information in relation to the locality of a disease among cattle in Butler County. I addressed a letter of inquiry to Senator Plumb, dated the 13th of October, and received the following reply:

WASHINGTON, D. C., *October 20, 1883.*

DEAR SIR: Yours of the 13th has just reached me. I do not know exactly whom to suggest that you call upon in Butler County for information about cattle disease, but if you call on Hon. A. L. Redden at El Dorado, or Hon. Neil Wilkie, at Douglas, they can put you on the track.

Respectfully,

P. B. PLUMB.

M. R. TRUMBOWER, V. S.,
Harper, Kans.

After the receipt of Senator Plumb's letter, I addressed the parties referred to and received answers from both, stating that I should go to El Dorado to find what I desired. I reached El Dorado on the 7th of November, and proceeded to Hon. Redden's office, but found him absent; his clerk took me to the bank of El Dorado and introduced me

to Mr. V. Brown, who, in turn, accompanied me to the city mayor's office and introduced me to him—Dr. A. Bassett.

Dr. Bassett assisted me very materially in my investigations and manifested the greatest degree of interest in my work while I remained at El Dorado. At his office I was introduced to the Rev. S. F. C. Garrison, who resides 3 miles west of El Dorado. He made to me the following statement: That he placed under the care of Mr. Matthew Robeson 18 head of cattle on the 17th day of April—17 of them being grown cattle, the remaining one a calf; that all of these cattle, excepting 2 head, were to be kept in the dry herd; that on the 1st of June 1 of these cattle was taken away from the herd, and on the 1st of July a second one was removed, leaving 16 head (including the calf) to remain. On the 24th of September the 16 were also taken home; this took place owing to the report that cattle were dying in this herd under suspicious circumstances. When Mr. Garrison took his cattle home he turned them into a field with 12 head of other cattle. On the 30th day of September 1 cow died after a sickness of two or three days; 11 of them died in rapid succession, the last death occurring on the 10th of October. All of the 11 that died had been removed from the Robeson herd; none of the home cattle became affected. Mr. Garrison observed the symptoms manifested during the course of the disease to be—

A peculiar odor arising from the skin of the affected animal; then a dry, hard, husky cough, especially when urged to move around; head carried extended; ears droop; pushing the head against straw-stack or fence; loss of appetite; no desire for water; rumination suspended; segregation; weak and staggering gait; saliva flowing from the mouth; whites of the eye assume a yellow tinge; perspire excessively toward evening, which is of a very disagreeable odor; shake the head from side to side as if in pain; trembling of the muscles sets in upon the slightest exertion; pulse beats rapid and hard; become unable to rise; partial coma and death ends the scene. One of them lived eight days; another five, and others from three to five days before dissolution took place; several died in strong paroxysms of pain, manifest by getting up and lying down very frequently, accompanied by violent efforts to urinate and defecate. The manure was usually covered with blood and mucus and the act of urination was very painful.

Mr. Garrison made three *post-mortem* examinations, and describes the following appearances:

Lungs filled with air and infiltrated with mucus; the lining membrane of the air-tubes seemed slightly congested and irritated; the chest cavity contained some bloody-colored water; the contents of the paunch were hard, and the medicine which had been administered had not been absorbed; the contents of the manifolds in two of the animals was baked and dry as tobacco, and the folds softened and rotten; the intestines seemed swollen, and the lining membrane coated with mucus; the kidneys were of a greenish color, softened, and enlarged; the urine bladder was distended with dark-colored urine, one of them containing fully one gallon of clotted black blood; the heart was pale and flaccid; the blood in all three cases was darker and thicker than natural; it seemed to be more like paint than blood; the spleen was greatly enlarged, and the inside of it broken up into a pulp; the liver was thickened and filled with blood, the outside color being a glossy green, some parts more highly colored than others; the gall-bladder contained in one case one quart of thick, viscid, yellowish granular bile; the large blood-vessels along the spine seemed diseased,

presenting an unhealthy internal surface; in one of the animals one of the horns became loose before death.

Loss, 11 out of 18; value, \$277; 3 recoveries.

Joseph Sharp, living in El Dorado, said that he had 3 cows with their calves, and 2 weaned calves in Mr. Robeson's dry herd; they were put in on the 12th of May, and removed on the 25th of September. One of them manifested signs of sickness on the evening when she was taken home, and in a week thereafter she died. This cow seemed to suffer more pain during the middle of the day than in the morning or evening. At the time the first one died, two others were found to be sick; they both died; the last death took place on the 5th of October. Three of the calves were sick, but recovered. Loss, 3 out of 6; value, \$125. *Post-mortem* examinations of 2 of the cows were made by Mr. Sharp. He found the bladder distended with a brownish-red urine, spleen twice or three times the normal size and very dark colored on the surface. In one of them, which had been purged by feeding corn and millet, the contents of the third stomach were found soft, in the other, the contents were hard and dry, "could be shaved down into chips," and the folds black and rotten. The blood in all 3 of them that died was too thick. Only 1 of these cattle passed blood with the feces.

Mrs. Smith lost one heifer in the Robeson herd on the 22d of September; another one, which she took home on the 25th, died on the 28th. She had only 2 head of cattle in the herd—value, \$60. On the 23d of September Mr. Robeson called upon S. P. Barnes, a butcher in El Dorado, to make examination of 2 head of cattle that died in the herd. Mr. Barnes gave the following statement:

I found one cow had been purging, and in this the contents of the third stomach were natural; the second cow had been constipated, and in her I found the contents of the third stomach harder and drier than natural. The livers and kidneys in both animals appeared pale and faded in color, as if the coloring matter had been removed.

In one I found the urine bladder was empty; in the other it was filled with bloody-colored urine; in the latter the inside of the bladder seemed hard and tanned, and almost black in color. The spleens were three times as large as natural, but the livers were not enlarged. One of the animals—a three-year-old cow—was not quite dead when I arrived at the place where she lay. I cut her throat, but hardly any blood escaped; the small amount which flowed was too thin and watery. The cow that I found dead, also, was almost destitute of blood. The tallow in both these cows was much too yellow, and I found this same yellow condition of the tallow in 8 or 10 other cattle which died afterward on the same range with the same disease. The meat of these cattle was light colored, like veal, and a disagreeable odor was present in all of the animals, dead and living. I never before saw any cattle sick with or die of Texas fever, but the moment I saw these I was satisfied that they died with that disease.

E. B. Cook, residing 7 miles northwest of El Dorado, stated that he placed 6 head of cattle—all cows and heifers—in the dry herd of Mr. Robeson on the 6th day of May, and took them away on the 23d of September. One of them died on the 27th, another on the 30th, and a third one on the 4th day of October. Two of them passed bloody urine. Two that were sick recovered. When he took them home he placed

them into a field with 14 head of other cattle. None died but those exposed on the Robeson range. Loss, 3 out of 6; value, \$100; 2 recoveries.

Mossman Bros. reside 8 miles northwest of El Dorado. History by Henry Mossman: On the 6th day of May 18 head of cows and calves were taken into the Robeson herd, and remained until the 25th of July. They were then sold to Bearsley & McAnaly. Twenty three head of steers were placed into this same herd on the 25th of July, and 17 cows on the 21st of September. On the 23d of September the steers and cows were taken home. One of the steers was sick on the day he was removed from the herd, and died on the day following; 6 more died in the course of three weeks, and 4 that were sick recovered. Of the 17 cows which remained in the herd only 2 days, 4 sickened, and 2 of them died—the first one on the 10th of October, the other one a few days later. The medication resorted to consisted in giving one gallon of melted lard at a single dose. In three cases this dose was repeated, and in a fourth one an addition of ten drops of croton oil was given. Out of the 4 so treated 1 died. None that recovered had been seen to pass bloody urine, but in a few the manure was covered with coatings of mucus and blood clots. Mossman Brothers made two *post-mortem* examinations, which revealed the following pathological conditions: Blood was contained in the bladder; in one blood extravasations were found in the region of the kidneys; also on the surface of the body, extending along the spine for a space of 18 inches. This one died twenty-four hours after the first evidence of sickness was discovered. The spleens were greatly enlarged; livers appeared about natural. The contents of the third stomach were normal in one case; in the other they were dry. Loss, 7 out of 23 steers, valued at \$315, and 2 cows out of 17, valued at \$60; 6 recoveries.

I tested the temperature of 4 of the animals that had been sick, which registered as follows: 103.2°, 103°, 102.6°, 102°; of one which had not been sick, 102.2° F. These cattle are all looking well, and are fattening rapidly. They are confined in a straw yard, and get all the corn they can eat. The hogs at Mossman's ate one of the dead cattle; ten days thereafter 4 of them were noticed to be sick; 3 recovered in about ten days; 1 died in five or six days. The one that died had a fit of apoplexy two months previous, and had never entirely recovered from the effects of it; was subject to involuntary discharge of feces and urine, and had an imperfect control over its movements. Matthew Robeson, a herder of cattle residing in El Dorado, made the following statement to me: That he has held a range for four successive years, extending from the corporate limits of the city of El Dorado 5 miles northwest, by 2 or 3 miles wide; that he has been herding cattle belonging to himself and to other parties on this range this season, beginning to take them in on the 17th day of April. The first death among his herd occurred on the 10th day of September—a cow owned

by Mr. Saxton; the second one which died was an animal belonging to Mrs. Smith; she died on the 22d; on the day following 2 head died belonging to Mr. King.

He then had an examination instituted, and as a result of that examination notified all the owners of cattle in his possession to remove them forthwith. Mr. Robeson also stated that he received into his herd on the 20th day of July 75 head of cattle belonging to Davis & Connelly, butchers, of El Dorado; that some of these cattle remained on the range until the 28th of September. They were half-breeds with the exception of 7 head, which were supposed to be thorough Texans. The Texans were in poor condition when they were brought on the range, and were marked on the middle of the left side with an inverted A (∇) brand. Again Mr. Robeson stated that he received from Isaac King 300 head of cattle on the 9th of June.

Mr. King bought, during the winter, along the north line of Arkansas and south line of Missouri 1,000 head of cattle, collected them at Fort Scott in March, shipped them at the latter place, and unloaded at El Dorado on the 25th of April. He drove them on the range north and northwest of El Dorado, and there herded them until the 9th of June. He then drove 700 of them into Colorado on his cattle ranch, and placed the remaining 300 head under the care of Mr. Robeson, who already occupied the range at that time with a number of the town and other cattle. On the 9th of August 120 head more of the King cattle were taken into Colorado. I next saw Mr. Connelly, of the firm of Davis & Connelly, and got from him the following history:

I bought on the 18th of July 68 head of half-breed cattle from Mr. Page. These cattle had been wintered on Deer Creek, 12 miles southeast of Caldwell, Sumner County, Kansas. When I bought them they were on a range, owned by Mr. Cox, 6 miles southeast of Caldwell, on Bluff Creek. I bought 7 head more to fill out the car; these were brought to Caldwell early in the spring from Beuton County, Arkansas. I unloaded at El Dorado on the 20th of July, and placed my cattle in the care of Mr. Robeson. When I bought the 7 head of Arkansas cattle they were with a herd of 50 or 60 good grade native cattle, a \$500 bull and several polled Angus cattle. None of the latter died during this season.

Mr. Connelly also informed me that Mr. Carter, whose farm adjoins that of Mr. Cox, lost 38 out of 50 or 60 head of cattle. Five of them were full blood polled Angus, and another a Hereford bull, for which Mr. Carter paid \$1,000 last spring. All of Carter's cattle were held securely in an inclosed field, and have not been exposed to any foreign cattle.

On the 10th I saw Mr. James Mossman, who had just returned from Caldwell, where he had been to ascertain where the Connelly cattle came from. As near as he could discover the 68 head were bought from Mr. Carter; had been wintered cattle, half-breeds; that Mr. Carter lost many cattle at about the same time that the cattle began to die at El Dorado, and that Mr. Connelly had bought the 7 head from a Mr. Smythe (the agent for Mr. Donaldson, of Arkansas City). These 7 head were supposed to be through cattle from the Pan Handle, and

were bought out of a herd on the Johnson and Hosmer range, near Caldwell, in the Indian Territory. On Sunday, November 11, accompanied by Dr. Bassett and Mr. Davis, I drove out to ex-Brig. Gen. G. T. Wilde's, who, with his copartner, Colonel Mason, are engaged in the breeding and feeding of cattle. Colonel Mason was absent from home, but General Wildes gave me the following history:

Mr. Mason visited Halstead, Harvey County, Kansas, in the month of August; here he found that a number of cattle had died—town cows—with the Texas fever, attributed to infection received through a herd of cattle brought from the line of Arkansas and Missouri; that these were the only foreign cattle brought into Halstead this season. These cattle must come very nearly, if not quite, from the same section of country as that from which the King cattle are said to be derived.

On the 12th I went out over the range where Robeson had herded his cattle during the summer. I found it to be an elevated ridge of limestone soil, extending for miles northward along the west side of the Walnut Creek. The Walnut Creek supplied the cattle with water morning and evening. The water was perfectly sweet and pure. At noon the cattle drank from a spring creek, which takes its origin from several springs located on the range. The grasses are the usual prairie grasses found throughout the middle section of the State, composed chiefly of bunch grass or blue top, blue grass, and here and there is to be seen small patches of buffalo grass, the latter occurring where there is alkali soil or the remains of what are called buffalo wallows.

I also went out with Mr. Robeson to examine and to see the condition of the King cattle. These are the only cattle which yet remain in the charge of Mr. Robeson and are located in a corral 2 miles west of town for winter feeding. I found them to be very diminutive cattle (mullet heads) and also in a very poor condition to withstand the inclemency of winter. Many of them were three-year-old steers, but none of them exceeded 600 pounds weight. Many of them, however, have been sick, but have so far recovered as to begin to lay on flesh again. I tested the temperature of 7 head that had been sick, which registered as follows: 100°, 100.2°, 99°, 101°, 101.4°, 102°, 101°; of four that have not been sick, 97.7°, 101.4°, 101.3°, and 100.8° F.

Through the kindness of Mr. Robeson I am enabled to make an accurate tabulated statement of the number of cattle that were placed in his care during the season, the dates at which he received them, and the time when they were removed from the infected range:

Date of reception.	Owners.	Number received.	Number died.	Number recovered.	Value.	When removed.
April 17	Rev. S. F. C. Garrison.....	18	11	3	\$277	Sept. 24.
17	Mr. Corey.....	5	1	.....	40	Sept. 23.
17	Dr. Gordon.....	1	.....	.....	.....	do
17	H. Saxton.....	1	1	.....	40	.....
17	V. Brown.....	1	1	.....	40	.....
25	Mr. Balch.....	3	.....	.....	.....	Sept. 23.
May 2	Mr. Cupples.....	2	1	1	40	do
3	Mr. Collins.....	1	.....	.....	.....	do
3	Mr. White.....	1	1	.....	40	.....

Date of reception.	Owners.	Number received.	Number died.	Number recovered.	Value.	When removed.
May 5	Mr. Pascal.....	1				Sept. 23
6	Mr. Carpenter.....	5	1	1	\$40	do ..
6	Mossman Bros.....	18				July 25.
6	E. B. Cook.....	6	3	3	100	Sept. 23.
6	M. Robeson.....	3				do ..
6	Mr. Jones.....	3	1		40	do ..
6	Mr. McAnaly.....	2	1		40	do ..
6	Mr. Stiler.....	1				do ..
12	Joseph Sharp.....	6	3	3	125	Sept. 25.
12	Mr. McIntyre.....	1				Sept. 23.
July 29	Mr. Glaze.....	3				do ..
Aug. 8	Mr. Sappington.....	1				do ..
23	Beardsly & McAnaly.....	100				do ..
June 9	Isaac King.....	300	26	25	500	Aug. 27.
9	Beardsly & McAnaly.....	3	1		40	Aug. and Nov. 10.
July 20	Davis & Connelly.....	75	(*)	(*)	(*)	Sept. 24.
May 6	Mr. Tuttle.....	3	3		115	do ..
6	Mrs. Smith.....	2	2		60	do ..
July 25	Mossman Bros.....	23	7	4	315	Sept. 23.
Sept. 21	do ..	17	2	2	60	do ..
	Milk herd.....	124	9		325	do ..
	Total.....	730	75	41	2, 237	

* Were removed in small lots, September 28.

The milk herd contained exclusively milch cows from town, but were herded on the same range with the dry herd, although the two herds were kept separated for convenience. Mr. N. Rittenhouse herded 300 head of cattle north of the Robeson range, but he came no nearer than 1 mile to the range of the latter; neither have the cattle in the care of Mr. Rittenhouse crossed any of the trails of the Robeson cattle or been exposed to them or any other cattle in any manner whatsoever. They have been supplied with water from Walnut Creek, and have grazed over the same character of soil and grasses as have the cattle of Robeson's. Rittenhouse has not lost a single animal out of his herd during the whole grazing season.

In view of all the facts and the circumstances, as they appear to me, I am compelled to attribute the appearance of Southern cattle fever at El Dorado to the importation of Southern cattle by Mr. Connelly.

APPEARANCE OF DISEASE THREE DAYS AFTER EXPOSURE.

On my way to Harper, in October, I met Mr. E. F. Osborn, of Mulvane, Sedgwick County, Kansas, who related to me his experience with southern cattle fever, viz :

On or about the 1st of October, 1869, my partner and I started from Salina with 240 head of high grade native cattle, bred by ourselves. We drove south 80 miles to Sedgwick City; then we crossed the through cattle trail, driving our cattle as fast as possible. We then drove 20 miles farther south and stopped for winter feeding. On the third day after crossing we found one high-grade cow sick; on the 5th she died, and a hundred more were sick; in ten days after the disease first appeared 200 of the 240 were dead. We then drove the remaining 40 head into the Arkansas River, and left them standing there in the water. Some of them were so sick that when they first went into the river they could hardly keep on their feet. Many of them remained there from seven to ten or twelve days; could not be driven away from the water; but they all recovered. These 40 head were the poorest in the whole herd of 240 when we started with them. Before we left Salina we had a hard frost, and dur-

ing the drive south we had several frosts and continuous cool weather. We considered ourselves safe in starting after the frost; but to obviate all danger we endeavored to keep a safe distance away from the through trail; therefore we kept 20 miles west of it until we had to cross it; we then turned a square corner and drove across the trail.

I asked Mr. Osborn if it might not be possible that they crossed trails of Southern cattle between Salina and Sedgwick, but he said he was sure they had not. If their cattle were exposed only to the through trail then the stage of incubation in the first cow was probably less than three days, positively not more than four.

Respectfully submitted.

M. R. TRUMBOWER, V. S.

STERLING, ILL., *December 20, 1883.*

W. L. Fuill, M. D.
 Veterinarian,
 1526 Race St., Phila.

INVESTIGATION OF SOUTHERN CATTLE FEVER.

REPORT OF DR. H. J. DETMERS.

Hon. GEORGE B. LORING,

Commisioner of Agriculture :

SIR: In the following I have the honor of submitting my report on southern cattle fever. In my last report I took the liberty of stating what has been accomplished, and what yet remains to be done; also what I considered as the chief object of my investigation, namely, to discover the true cause of that apparently mysterious disease. My observations and experience of last year more than ever convinced me that the (exciting) cause of southern cattle fever consists in something intimately connected with or dependent upon the peculiarities of the Southern flora, and not—at least not directly—due to the climate and higher temperature of the Southern States, which only indirectly exerts its influence or aids in its production and propagation. The cause of southern cattle fever consists in something that requires for its production certain conditions given in the Southern States, or in those parts of our extensive territory in which the fever has its origin or permanent source. Some, perhaps most, of the conditions favorable to its development, and some of those unfavorable to the same, are known. If one carefully studies the facts communicated in my last report, he will find that decaying vegetable substances, a certain degree of warmth and moisture, and a low elevation above the ocean, are necessary requisites and important factors in the development of the infectious principle; while a low temperature, a high altitude, and, without hardly any doubt, an absence of moist and decaying vegetable substances are detrimental to its propagation. In proof of this, allow me to briefly restate some of the more salient facts, apparently in part contradictory of each other, but facts notwithstanding. As, however, my experience has only been with Texas and Western cattle I will limit my remarks to them, without intimating, though, that I regard the disease in question as an exclusive product of Texas or of the Southwest, for it is a well-known fact that other Southern States and the West Indies are just as well a source of southern fever as Texas.

1. Native Texas cattle never contract southern cattle fever, and possess immunity against infection as long as they remain on their native range or north of the same, provided they are not kept long enough north

(in any of the Northern States) to become there acclimated, or, in other words, have never passed a winter in the North. But the same cattle if taken from their native range and driven or shipped south will gradually lose their immunity in proportion to the distance they go further south, and thus, if going far south, finally become liable to be infected and to contract the fever. This shows the infectious principle must be the more intense the further south the locality.

2. If Texas or other Southern cattle, to all appearances themselves perfectly healthy, are shipped or driven North, away from their native range, after new grass has appeared and become interwoven or intermixed with the old dead grass of last year's growth, which, owing to the warmer weather and the usually abundant rains of the early Southern spring, is in a decaying condition, and these cattle, thus compelled to eat both the intermingled old and new grass, have but once taken a good meal of this mixed herbage, they will as soon as they arrive at a certain latitude further north infect every trail and pasture on which they graze, and every water-hole out of which they drink, with the infectious principle of southern cattle fever. And the native Northern cattle following them will, after some interval of time (period of incubation), contract the disease, as a rule, in its most fatal form.

3. If Texas or other Southern cattle are moved to the North before any new grass has made its appearance on their native range, or rather before the dead grass of last year's growth has commenced to decay, no infection of Northern pasture, &c., will take place, no matter how far north the Southern cattle may be shipped or driven. If, however, the cattle, thus leaving their native range in the South early in the season, or in the winter, should travel slow enough to be yet within a part of the South in which the southern cattle fever has its permanent source, when warm weather and abundant spring rains cause a decay of the old grass and start a vigorous growth of the new, the effect will be precisely the same as if the cattle had been kept that long on their native range; only the infectious principle imparted to the Northern pastures, &c., may be a trifle less virulent, and taken up by Northern cattle may cause a somewhat milder, though in a majority of cases yet fatal, attack of the disease. I had repeated occasions to observe that the fever, as a rule, is the more severe the further south the source of the infectious principle.

4. Northern cattle shipped to Texas, or to other parts of the South, will contract the disease, and as a rule die of it, if only once pastured soon after their arrival on land that contains both old and new grass—particularly if it is so-called hog-wallow land—or if only once allowed to drink out of a water-hole receiving the drainage of such land.

5. Grown Northern cattle imported into Texas usually contract the disease with more certainty, and in a more fatal form, than imported, Northern calves and yearlings. Whether such is the case because the latter have a smaller mouth, are more dainty eaters, and better able to

pick out the blades of grass they want, and to refuse what they do not like, or whether their young organism is better adapted to resist the influence of the pathogenic principle, I will not now decide, and will only mention that some young animals, even calves, contract the disease in just as acute and severe a form as full-grown cattle.

6. In the North—say north of the southern boundary line of Kansas—the disease is only communicated through trails, pastures, and grazing grounds, or rather their grasses and other food-plants, and water holes previously infected by Southern cattle; but it usually does not make its appearance until the latter part of July or in August, or until the Northern prairies, fields, and pastures, owing to the heat and often abundant rains of the summer, contain a comparatively large amount of vegetable debris or decaying vegetation, which, it seems, is an important factor in propagating the pathogenic principle if once deposited. That a propagation of the once deposited pathogenic principle actually takes place on the grass or herbage of the trails, pastures, or grounds, &c., and outside of the animal organism, is demonstrated by the fact that the period of incubation, as a rule, is a long one, if the native Northern cattle immediately, or within a few days, follow the Southerners on the trails, pastures, &c.; while it usually is considerably shortened if a few or several weeks intervene between the time at which the Southern cattle left and the time at which the Northern cattle entered the infected premises. As, however, the infectious principle is not volatile, and is not disseminated through the air or by winds, its propagation on the grass and herbage of the infested grounds may not be the sole cause of shortening the period of incubation, and the difference just stated may also, to a certain extent, be accounted for by the following fact: In about two, three, or four weeks after a herd of cattle has left its grazing grounds (trail, pasture, prairie, &c., as the case may be) a fine crop of young and juicy grass will be found, if the season is not unfavorable to its growth, wherever the cattle have grazed; while at all those places or spots where they have not been grazing the grass will be comparatively old and tough. If a herd of native or Northern cattle immediately follows a herd of Texas or other Southern cattle, which have infected the premises with the pathogenic principle of southern cattle fever, the former will principally graze where they find grass, and not where the Southern cattle have cropped it, and where they, at the same time, have deposited, as I shall explain further on, the infectious principle. But if the herd of Northern cattle enters the pastures, &c., formerly occupied by the Southern cattle two, three, or four weeks after the latter left them, or after a new crop of young grass has made its appearance, the former, for obvious reasons, will prefer to graze at the very places where the Southern cattle have grazed, and deposited the pathogenic principle. As it is well known that the length of the period of incubation depends, to a certain extent at least, upon the quantity and intensity of the infectious principle taken up by the animal organism, no further explanation will be necessary.

7. In higher altitudes, such as in Colorado for instance, the southern cattle fever, although sometimes appearing after an infection of the grounds by Southern cattle, is much less malignant than in the lower countries farther east, and comparatively seldom proves fatal, a fact which may find its explanation that in a higher altitude the atmosphere is thinner and dryer, and less charged with organic substances; besides, the temperature, on an average, is lower. All this is less favorable to a decay of vegetable substances and a propagation of bacteritic growth than the warmer climate and the more dense and moist atmosphere of a lower country. The dead or dried grasses of the Colorado plains, under the influence of the dry air, and often prevailing dry winds, are ground to dust, and thus disappear before any decay sets in.

8. The morbidly affected tissues of animals affected with or killed by the southern cattle fever, even if examined at once, invariably contain bacteria* of the micrococcus and bacillus kind, and it appears to be very probable, particularly in the light of recent research in regard to infectious diseases and their causes, that at least one of these two kinds of bacteria bears some causal connection to the morbid process. My own observations, examinations, experiments, and a careful consideration of undeniable facts, point toward the bacilli, and not to the micrococci. My reasons I shall take the liberty to state further on.

9. If all the facts known in regard to the communication of southern cattle fever to Northern cattle by means of trails, grazing grounds, pastures, water-holes, &c., are duly considered as they present themselves, there can hardly remain any doubt that the infection of the trails, pastures, &c., must be effected by means of the saliva or slaver of the southern cattle. In proof of this assertion I may be allowed to state a few facts bearing on this point, and also to briefly dwell upon other theories now and then advanced. First, as to the latter. One theory charges the infection to a deposit of the urine of the Southern cattle. If it were the urine that causes the infection only those comparatively small and far apart spots in which the urine of the Southern cattle is deposited would be able to communicate the disease to Northern cattle, for it has been established beyond a doubt that the infectious principle is not carried through the air or disseminated by winds, and that even a wire fence separating a pasture occupied by Northern cattle from a trail or pasture of Texas cattle (*cf.* my last report) is ample protection. Besides, cattle are not apt to graze where another animal has urinated; and as the urine is soon absorbed by the ground or evaporated it could never be explained how it can be possible that the infectiousness of a pasture or trail increases in intensity, at least for several weeks after the Southern cattle have left it. If the urine constituted the vehicle of the infectious principle, the wholesale infection of every Northern herd of cattle that passes over and grazes on a trail of the Southerners, or feeds on

* The word "bacteria," unless otherwise stated, is used as a generic term, because better understood by the average reader than Schizophytes or Schizomycetes.

a pasture that has been occupied by the latter, would hardly be possible, and, at the utmost, only one or a few animals of a herd would contract the disease. Another theory charges the excrements of Southern cattle with constituting the vehicle of the pathogenic principle. The objections just made against the urine theory will also dispose of the dung theory; besides, all cattle, but particularly grown animals, carefully avoid to graze where other cattle have deposited their excrements. They are apt to sniff at places where horses have voided their dung, and when suffering from certain digestive disorders, attended with a vitiated appetite, may even eat some horse manure, but they will never graze if they can help it where the dung of their own kind has been deposited, a fact well known to every cattleman. It may be possible that some pathogenic bacteria pass off with the dung, or even with the urine; but if they do, they most assuredly do not furnish the principal source of infection. Another theory charges the hoofs of the Southern cattle with being the communicators of the infectious principle. This theory, too, can be easily disposed of, even if it were possible that the hoofs were able to take up the pathogenic principle (bacteria, for instance), at the native range, and convey it to some other place, that other place could only be in the immediate neighborhood, because at every step in the grass the hoofs are wiped, and in mud or water they are apt to lose whatever may cling to them; besides, neither the horn of the hoof nor the skin of the foot constitutes the soil or medium needed for the reproduction, preservation, and propagation of such a pathogenic principle as that which causes the southern cattle fever. Even if the skin of the foot, particularly in the cleft between the hoofs, constituted a suitable medium, and afforded all the conditions necessary to the existence and reproduction of the pathogenic principle, the constant wiping and friction which those parts are subjected to on the march would preclude the possibility of conveying the principle (bacteria) in that way a thousand miles or even farther. Still another theory, which has yet a great many adherents even among practical cattle-men, charges the ticks often found on Texas cattle with being the bearers of the infectious principle, or even with constituting themselves the pathogenic agency. The principal objection that can be brought to bear against this theory is the fact that Southern cattle free from ticks will infect Northern pastures, &c., just as soon as those that have them, and that ticks of the same kind also occur in countries in which the southern cattle fever never originates or makes its appearance, unless it is introduced by Southern cattle infecting a trail, pasture, water-hole, &c. The perspiration (through the skin) of Southern cattle, and even the expirations (from the lungs) have been accused of constituting the pathogenic principle, or the vehicle of the same. But this theory, too, is fallacious, for, if true, the pathogenic agency would be of a volatile nature, and be communicated through the air, which it evidently is not, as already stated. Hence, the only thing that remains as the probable vehicle

and medium of the pathogenic principle is the saliva or slaver of the Southern cattle deposited by them, not only wherever they graze and wherever they drink, but also often dropping in strings from their mouths when on their march. Any one familiar with droves of Texas and Cherokee cattle will have observed that they produce more saliva and slaver more profusely than any other cattle not driven, or at rest; and cattle, when grazing, while grasping with their tongues a bunch of grass, and drawing it into their mouth to be cut off by their incisors, necessarily soil the stubbles which remain standing with their saliva, particularly if slaving, as traveling Texas cattle always do. This saliva or slaver is somewhat sticky, and the microscopic organisms (bacteria) it may contain are thus temporarily glued to the grass that remains on the ground. The bacteria, thus deposited with the slaver (saliva and mucous secretions of the mouth), find a new soil which offers them all the conditions necessary to their existence and propagation, particularly if old and decaying grass or vegetation, as is usually the case, is existing among or between the stubbles of the grass that has been torn off. Dew and rain afterward provide the necessary moisture and also the means of further distribution. If the Southern cattle, before being shipped or started on their journey toward the North, take up on their native range or at any place between their Southern home and their Northern destination, but south of a certain latitude, the pathogenic bacteria of southern cattle fever—and there can be hardly any doubt that bacteria which have their source or origin in the South constitute the infectious principle or the cause of that disease—either with their food or their water for drinking, the bacteria, of course, will first pass into the paunch, where they find all the conditions (a suitable medium, warmth, and moisture) necessary to their existence and propagation. Ascending to the cavity of the mouth with the juices of the paunch when the animal is ruminating, they find a new and, at the same time, excellent medium in the saliva and mucous secretions, and thus it becomes possible not only that the bacteria retain their vitality, and that the same vastly increase in numbers, even if the journey of the cattle, as to time and distance, is a long one, but also that one herd of Southern cattle is able to infect a large territory (trails, pasture-grounds, &c.), at a long distance, a thousand miles or more from their native range. I might advance several more arguments in proof of the assertion that grazing grounds, trails, pastures, yards, water-holes, &c., are infected by means of the slaver, and that all other theories are untenable, but to do so will be in time, and can be done with much more force, after it has been proved beyond a doubt that a certain kind of bacteria constitutes the true and the sole cause of the disease. To conclude, I may be allowed to remark that all the phenomena of an infection—the non-volatile character of the infectious principle, the varying period of incubation, the more frequent occurrence of the disease in different seasons according to latitude, the kill-

ing of the infectious principle by continuous cold weather, or by a heavy frost, and the wholesale infection of Northern herds of cattle—will find a full explanation, if the slaver constitutes the medium, in which the pathogenic principle lives and propagates in the Southern cattle when taken north, and in which it is deposited on the grass, in the water, &c., while the same cannot be explained, if not the saliva, or rather the saliva and mucous secretion combined, but something else constitutes the medium.

As above stated, I have reasons to believe that of those bacteria found in the morbidly affected parts, particularly in the liver and in the spleen of cattle affected with the southern fever, the bacilli and not the micrococci constitute the pathogenic principle, or bear a casual connection to the morbid process. Still, I will not deny that the micrococci, too, may possibly possess septic properties, particularly if obtained from a part in a state of dissolution, for instance, from the spleen, an organ which I invariably, at every *post-mortem* examination, found to be in a disorganized condition, even if the affected animal has been killed by bleeding or by a pistol-ball. Such micrococci, if inoculated into the organism of a healthy animal, may have a septic effect, and may even cause disease and death, and still may not constitute the infectious principle of the southern fever. According to what is known of the behavior and the pathogenic action of the various known pathogenic bacteria the morbid process and the morbid changes in southern cattle fever point toward bacilli and not at all toward micrococci as the probable cause. Particularly the fact that the infectious principle, whatever it may be, is never conveyed through the air from one place to another, and requires in order to produce morbid changes in an animal a very long period of incubation, and then rather suddenly develops its malignant action, it seems to me almost excludes the possibility of a micrococcus constituting the cause. It is true, in anthrax, a disease known to be caused by a bacillus, the period of incubation is a very short one, at least in those cases in which the disease is communicated from a diseased to a healthy animal, but the attack invariably is a sudden one, and *Bacillus anthracis* not only shows a very rapid propagation, but is also otherwise entirely different from the bacilli found in southern cattle fever. A micrococcus, as a rule, propagates too rapidly to require a very long time for the development of its pathogenic action, and would fill the whole organism, and very likely be found in every drop of blood, long before the sometimes very long periods of incubation of the southern fever has expired; besides that, every infectious principle known to consist of micrococci or diplococci is more or less volatile and can be communicated through the air, while those consisting of bacilli usually show a different behavior. But of course, if there were no other reasons, those just given, resting only upon analogy, might not carry much weight, or decide anything, and might be met by saying that the micrococci or diplococci found in

southern cattle fever may be entirely different in their behavior from any other known species of pathogenic micrococci. There are, however, some other facts which tend to show that the bacilli and not the micrococci most likely constitute the pathogenic principle.

1. The bacilli are a constant occurrence in the diseased parts, but particularly in the liver and in the spleen of cattle that are affected with or have died of southern cattle fever.

2. The bacilli sufficiently differ in shape and size from all other well-known species to be at once recognized when seen under a sufficiently high power, a fact which I intend to demonstrate, not by a description or by drawing, but by photo-micrographs, as soon as I shall be able to obtain fresh material in which the bacilli have not been subjected to any change whatever by the action of hardening fluids or reagents.

3. In three sections of liver and spleen recently mounted in balsam, but cut last winter from pieces of liver and spleen which were hardened thirteen months ago, when perfectly fresh, in alcohol and in a solution of bichromate of potash, and have since been preserved in alcohol, the bacilli are yet intact, and under a high-power homogeneous immersion objective are easily recognized as the same kind of bacilli which I never failed to find in the diseased livers and spleens when examined fresh. Besides, the bacilli do not merely adhere to the surface of the sections, but appear to be imbedded in the tissue, because they are found at different depths, and require to be seen under a high power and different focusing, according to the plane in which they lie. The sections, when cut last winter, were stained in "Beale's carmine," and before being mounted were restained in an aqueous solution of methyl-violet (1:500), but after they had been in alcohol and oil of cloves, and been mounted, the aniline staining had almost entirely disappeared, been washed out by the alcohol and oil of cloves, and thus the bacilli, which did not take the carmine stain, appear but indifferently stained with methyl-violet, and are rather pale, but are plainly seen and easily recognized.

4. The micrococci or diplococci that may have been present in the liver and spleen are now absent, at least cannot be found notwithstanding a most careful search, which proves to me that the same, if they have been present in those tissues, must have been there by accident, or have existed only in the fluids, and have never been imbedded in the solids like the bacilli. In my opinion the facts just related plainly show that the presence of the bacilli cannot be an accident, but must have some connection with the morbid process.

Last year, when investigating the southern cattle fever in the Southwest, and even before, when I made my first observations on that disease and several *post-mortem* examinations of cattle that had died in Champaign, I became fully convinced that I had to deal with a bacteriemic disease, or with a disease that owes its existence to some pathogenic bacterium. As it is admitted that the southern cattle fever has its

origiu or permanent source in the South, I could not help arriving at the conclusion, after taking all the peculiarities presented into consideration, that the pathogenic principle (bacterium) must be connected with, or be dependent upon, the flora of the Southern States, and cannot be the direct product of the climate or the higher average temperature. Having found the bacilli in the morbidly affected tissues several years ago at my first examination of the southern cattle fever at Champaign, and considering them, even at that time, as the probable, or at least possible, cause of disease, I naturally looked, when in Texas, for something corresponding to be found on, or to be connected with, the herbage and grasses which constitute the food of the cattle on the Texas cattle ranches. The well known experiments of Dr. Buchner directed my attention to infusions—natural and artificial—of the dead and decaying grasses of Texas hog-wallow land—to those of the latter in particular, as it was repeatedly stated by experienced Texas ranchmen that hog-wallow land is considered as the most dangerous grazing ground for cattle recently imported from the North. The natural infusions I found in the spring prepared in the so-called hog-wallows themselves, and the artificial infusions were made by putting some of the dead grass in a vessel and pouring rain-water over it. When examining my infusions, I found, as could scarcely otherwise be expected, a variety of microscopic organisms (bacteria), but among them, in larger or smaller numbers, invariably a bacillus which, in every respect, closely resembled both in size and form those bacilli which I had found before and found afterwards in the liver and spleen of the diseased cattle—certainly something worthy of further investigation.

As I look upon it, the principal object in investigating an infectious disease, particularly if the same is very fatal, causes great losses, and is capable of spreading a great distance, must be to ascertain the true cause, and to become acquainted with its nature and its mode of action, and the means and conditions necessary to its existence, propagation, and communication. As long as we are in the dark in regard to the cause of a disease, particularly if the latter is infectious, our treatment and our prophylactic measures can only be of an empirical character, and at best be very uncertain. But as soon as we know the cause, its mode of action, its means of existence, and its manner of propagation and communication, we have gained a great advantage, for then, if the cause is accessible and can at all be destroyed its effects can be neutralized or its propagation and communication can be prevented. The possibility is then given to devise rational measures which will have the desired effect. Therefore, sincerely believing, nay, almost convinced, that my endeavors to discover the cause of the southern cattle fever are in the right direction, it is and has been my desire to subject my conclusions, above stated, to a practical test, and to decide by experiment whether the same are correct or erroneous. Last year I made some efforts in that direction, but

the experiments, for reasons stated in my last report, did not meet with satisfactory results, and some unavoidable mistakes were committed. So, for instance, I inoculated a Texas cow, which undoubtedly possessed immunity, but was the only animal at my disposal, and as I had to remain in Texas I delegated that part of my experiments, of which success might have been expected, because to be carried out in the North, where the cattle do not possess immunity, to a friend. It also miscarried for reasons stated in my last report. Another experiment, made by myself in the North, was made on very young animals, and too late in the season, and besides this, some other mistakes, partly unavoidable, and known to be mistakes when made, and partly due to a want of facilities and inexperience, were committed, which it will not be necessary to enumerate, for they will be avoided in the future. All this combined, however, amply accounts for the want of success, which, therefore, has not decided anything. Besides it is to me exceedingly doubtful whether a disease not known to have ever been directly or indirectly communicated by a diseased animal to a healthy one can at all be inoculated in the usual way. At any rate no well authenticated case of any direct infection or communication of the disease from a diseased animal to a healthy one is on record, while many cases are known in which animals took sick with southern cattle fever and died of it in the midst of healthy herds and none of the healthy animals, unless previously infected, ever contracted the disease. Neither is it positively known that Northern cattle or cattle themselves susceptible to an infection ever infected northern pastures, &c. Still, whether under certain circumstances they are able to do so is another question. Northern or susceptible cattle, grazing on premises or drinking out of water-holes infected by Southern cattle almost invariably contract the disease and die of it before the system becomes accustomed to the action of the pathogenic principle (the bacteria), and charged with the same to such an extent that the latter will be present, and be constantly reproduced in the mucous secretions of the mouth and in the juices of the paunch.

But it stands to reason, if they (the Northern cattle) gradually acquired immunity like the Texans, and then continued for a certain length of time to occupy infected premises and to take up the infectious principle, or if it were possible to charge their system with the pathogenic principle, as just indicated, before they contract the disease and die of it, then these Northern cattle, if driven to uninfected pastures, would probably infect the latter just as effectively and just as soon as Southern cattle, particularly if the Northern cattle were first driven like a herd of Texans, and thus caused to slaver. That susceptible cattle, or such as will contract the disease, do not communicate it to others, strange as it may seem, probably also admits an explanation, if all known facts are taken into due consideration.

In the first place, the pathogenic principle (the bacteria) of south-

ern cattle fever does not seem to be indigenous to the animal system, but very likely belongs to the decaying grasses and herbage of the South, and only by what may be called accident enters the animal organism. In Southern cattle, or in such as possess immunity, that is, in such in which the pathogenic principle (the bacteria) produces no morbid changes important enough to seriously disturb the health of the animal, the organs, which constitute the principal seat of the morbid process in diseased cattle, the liver, spleen, &c., it seems, have either become accustomed to the action of the bacteria, or else have gradually become sterilized ground, and thus cease to be a favorable medium. That such is the case will be understood, if it is kept in mind—1, that the first introduction of the bacteria into the organism of Southern cattle takes place while the latter are young calves, which, as is well known, possess much less susceptibility than grown cattle; 2, that the number of bacteria taken up the first time undoubtedly is a comparatively small one and not sufficient to cause serious mischief, but just large enough, particularly if supplemented by successive small invasions, to gradually cause an immunity, which, although but temporary, will last for some time after the invasions have ceased. As long as Southern cattle occupy infected territory the bacteria will enter their organism with the food and water for drinking, and finding in the paunch all the elements necessary for their development and propagation, many of them probably reach the cavity of the mouth by ascending with the food and the juices of the paunch during the process of rumination, and then in the mucous secretions and saliva again find a favorable medium in which their existence and propagation are fully secured, and by which they become glued to the grass, &c., as has been above explained. It is possible that a great many of the bacteria taken up with food or drink, or developed in the paunch, and, may be, the majority of them, pass on with the food through the digestive canal, and are discharged with the dung; but if they are they will be comparatively harmless, because they will be confined to those spots at which the dung is dropped, and at which other cattle, as a rule, do not like to graze.

If Northern cattle, not at all accustomed to the action of these bacteria, take them up with this food or drink for the first time, the bacteria likewise enter the paunch, and propagate in that organ, but passing on into the other stomachs and the intestines, they probably cause increased activity and increased absorption, or even lesions, by irritating the mucous membrane, and thus may find their way into those organs—the liver and the spleen—in which afterward the morbid process of the Southern fever has its principal seat, while in Southern cattle such an irritation of the digestive canal, which in them has become accustomed to the presence of the bacteria, is either very limited or does not take place. That the bacteria, or whatever may constitute the infectious principle, produce irritation and congestion in the digestive canal,

resulting in most cases in increased absorption in the third stomach, and in lesions in the fourth stomach and a part of the intestines, is demonstrated by the morbid changes usually found in those organs at *post mortem* examinations. It is, however, also possible that the bacteria, or a large number of them, reach the liver, the principal and, according to my observations, primary seat of the morbid process, in a more direct way—through the duodenum. The bacteria, if once passed beyond the second stomach, or domiciled in interior organs, for instance, in the liver, spleen, &c., cannot very well ascend to the mouth, there mingle with the saliva and mucous secretions, and thus be deposited on the ground; consequently Northern cattle cannot very well infect pastures, &c., unless every day a new lot of bacteria is taken up and propagated in the paunch, as is the case with Southern cattle. Of course the explanation just given I wish to be considered only as a strong hint. Something more definite may be said after it has been conclusively demonstrated what bacterium constitutes the true cause of the southern fever.

When returning to Texas last spring—I arrived in San Antonio about the 1st of May—it was my intention, as I explained on the 24th of April, when in Washington, to collect and to prepare what I believe to be infectious material, and to return to the North in about a month to complete my preparations (bacillus cultivations, &c.), and then to put them to a practical test. I intended to return to the North for two reasons: First, no southern cattle fever could be found in Texas, nor could it be expected to occur before December, because the native Texas cattle possess immunity, and the Texas ranchmen, at least the more intelligent ones, and all those who have had any experience with the Southern fever, take care not to import any Northern cattle except late in the fall and in the winter, for they have found that to be the least dangerous season of the year. Secondly, my proposed experiments could only be expected to give satisfactory results if made on susceptible Northern cattle, and at a place where a natural infection is out of the question. But in the latter part of May, when my preparations were nearly completed, and I about ready to leave for the North, circumstances beyond my control compelled me to remain in Texas. Of course my plans could not be carried out, my preparations could not be used, and the question I was so anxious to decide for the time being had to remain unsolved. I had orders to investigate, besides southern cattle fever, also other infectious diseases of more than local importance. But in Texas the infectious and contagious diseases of domesticated animals, which are of general interest, or of an epizootic character, are very few in number, and without any fear of contradiction I may say there is hardly a country on the globe in which cattle and live stock in general are less subject to disease than in Texas. It is true Texas ranchmen sometimes suffer great losses, particularly in the latter part of winter, but these losses are not caused by disease, and almost with-

out exception result from want of food, want of water, or want of shelter in inclement weather. Losses that occur during the summer months are far less severe, and are mostly caused by insects and their larvæ.

Besides the southern cattle fever, which does not, at least not visibly, affect the native Texas cattle, the only infectious disease of any importance is so-called "black-leg" or "black quarter" (the *anthrax symptomatique* of the French), but even this disease occurs only at certain localities and during certain seasons of the year, particularly in the spring, and in my opinion will become a rare occurrence in the grazing districts of Texas as soon as Texas stockmen will learn that dead animals must be buried or be cremated, and that it is bad policy to allow live stock to drink the water of stagnant pools. The infectious and epizootic diseases occurring among sheep were investigated last year, and although I do not claim that everything worth knowing about them has been brought to light, enough is known to enable the Texas flock-master to apply such measures of prevention as will protect his flocks. Besides, the spring is not the time in which those sheep diseases make their appearance, and, owing to a severe winter (severe for Texas at least), hardly any case occurred or came to my knowledge. Last year an epizootic disease occurred among the horses on the Gulf coast, but this year nothing of that kind happened, at least not as far as I was able to learn. So not much could be done, except examining some cases of so-called "black-leg," and in regard to these I was not able to ascertain anything that is not already known, because being in a thinly settled country and far from home I lacked the necessary facilities, such as a laboratory and experimental station. If it is desired to study and to thoroughly investigate the disease known as "black-leg," it can be done more easily and with better facilities in a more thickly settled country, where the distances are not so great as they are in Texas. Hence toward the end of July, or about the first of August, I asked the Department, briefly stating my reasons, to be recalled from Texas, and in reply to my letter I received orders which assigned me to other work. So I left Texas in the forepart of August.

Very respectfully submitted.

H. J. DETMERS.

DECEMBER 1, 1883.

CONTAGIOUS ANIMAL DISEASES.

BY EZRA M. HUNT, M. D., SC. D., TRENTON, N. J.

The relations of domestic animals to the public health—to food and milk supply—the comparative study of their diseases as throwing light on human ailments, and the immense financial and commercial import of any serious diseases occurring to them, cannot but impress any one who will give to the subject that consideration which its importance demands.

In 1862 the medical officer of the privy council of Great Britain made an important report on the diseases of live stock in their relations to the public supplies of meat and milk. In that paper Prof. John Gamgee states the number of horned cattle in the United Kingdom at 7,646,998, and calculates the loss by deaths among these animals at £6,000,000. The census of 1880 states the number of food animals in the United States at 91,805,232. The chief epizootics named in the report referred to are rinderpest, or typhoid or enteric fever of cattle, which always spreads from the Russian steppes; contagious pleuropneumonia of cattle, a disease always extending from Central Europe, though probably traceable to Asia and Africa, in some parts of which it is a very common disease; the epizootic aphthæ, murrain, or the foot-and-mouth disease, and sheep-pox. Of the enzootic diseases, which depend on local causes, and one parallel to endemics in man, anthrax or carbuncular fever takes the lead. Of this there are so many varieties of classification and description that we cannot yet be said to have a settled nomenclature. Thus, splenic apoplexy, braxy in sheep, the black-leg or quarter-ill of Britain, and other erysipelatous forms in the sheep and pig, boils and carbuncles, parturition fevers, hog cholera, Texas cattle fever, and some other ailments have been included in this class. Add to these the parasitic diseases of animals, and we have a score or more of diseases which are either deadly to the animals or injurious to meat and milk as food products. Many of these are communicable, not only to different varieties of animals, but to human beings as well.

None of these diseases are claimed to have originated on American soil, except it be the Southern cattle fever, which is regarded by many as only a variety of anthrax. When we consider, too, that rinderpest, pleuro-pneumonia, and foot-and-mouth disease were brought to Great Britain from the Continent, and that the ravages of these diseases have

cost and are costing the British Government millions of pounds sterling annually, is it not wise for us to accept the signals of precaution and prevent them from becoming indigenous? As yet rinderpest and foot-and-mouth disease have not obtained a foothold, and contagious pleuro-pneumonia has not passed the point of possible extinction. Pleuro-pneumonia reached England about 1842; foot-and-mouth disease in 1839; sheep-pox in 1847. Of rinderpest there have been four outbreaks, viz., in 1745, 1865-'66 (the most destructive one), 1872, and 1877. We have been singularly fortunate in that we have escaped two of these formidable diseases. Rinderpest is not very likely to obtain a foothold here, but foot-and-mouth disease, with its great contagiousness and its immense loss to milk-producing animals, is greatly to be feared. Fortunately, rumors of an outbreak in the Far West proved to be unfounded. But the fact is well known that more than once it has arrived at our ports from abroad, and has been prevented from spreading here by rigid inspections on arrival and close quarantine after landing. During the past year the disease has been so prevalent in the United Kingdom as to cause widespread alarm and great pecuniary losses.

We propose in this paper to state some facts, observations, and opinions as to contagious pleuro-pneumonia, and also, in connection with the detail of some experiments as to foot-and-mouth disease, to offer a few comments upon it.

CONTAGIOUS PLEURO-PNEUMONIA.

The general course and symptoms of pleuro-pneumonia are so well known, and have been so fully and accurately described in the reports of the United States Department of Agriculture, that there is no need of repeating them here. The only points upon which perhaps there is need of more extended observation and a more concurrent testimony is whether climate or other conditions have modified this disease as found on American soil, and whether different grades of stock are equally subject to its ravages. No one can see much of the disease without being struck with the great variations in its malignancy. We have seen outbreaks in which every animal attacked seemed early to become mortally sick, and where one or both lungs changed in a short time from a weight of three pounds to over twenty. In other cases the course of the disease has seemed mild, and most of the animals were likely to recover. This has led to a distinction among some veterinarians, so that they have come to speak of certain cases as English or European, and of others as American cases. It would be a good service if this Department could obtain the comparative statistics of English and American cases, and the accurate testimony of creditable veterinarians who have had in charge many cases both in this country and abroad.

It has been asserted that in certain exposed sections, as on Staten Island, common pneumonia is frequent and fatal among cattle, and that some of these have been mistaken for contagious pleuro-pneumonia.

We last year offered to visit, on notice by telegraph, any such cases of common pneumonia, which an extensive practitioner there asserted he had frequently seen, but as yet have received no such notification.

The contagious character of pleuro-pneumonia in this country has certainly not diminished with the change of climate. Still there is some reason to believe that our severer winters tend to freeze out the disease, and, where there has been a full exposure, give us a better hope of interrupting its contagiousness; yet the contagion itself seems very persistent unless there is subjection to freezing and to various methods of disinfection. It is well established that after an outbreak had ceased for a year or more, the removal of the old barns and the exposure of the unfrozen ground beneath at once revived the disease. A case not long since occurred on Long Island where the transfer to the new sheds and the destruction of the old, near by, seemed to originate or reproduce the plague. Facts are accumulating to show that the accidental protection from frost caused by shelter seems to continue some of the contagions both of men and of animals. This is one of the contagions probably not wafted far, but quite indestructible unless largely exposed to air, to severe cold, and to disinfection.

But the most important question of all pressing upon our attention at the present time is whether we are to forsake the method of stamping out the disease by occision, and to substitute the system of inoculation as first practiced in Belgium and Holland, and as revived in Scotland under the auspices of Rutherford and Williams, and as sanctioned also by Fleming and others. This is the more important because, under the advice and approval of the Drs. McLean, the board of health of the city of Brooklyn has allowed or authorized this system in its stables, and at a point where the disease has long had a foothold. At one time Professor Law expressed the hope that the inoculation method, under some modifications, would be revived. In New Jersey the State law permits inoculation, under expert oversight, in a herd in which there has been an outbreak, if such inoculation is ordered or approved by the board of health. In the last instance the law was based on the views of Rutherford, Williams, &c., and on the fact that the State despaired of securing riddance of the disease, with reasonable expenditure, if it must be constantly subjected thereto by the transportation or driving of cattle from infected localities in other States.

The details of inoculation as followed out in New Jersey are of much interest. Through the influence and practice of Mr. Lamerz, a German veterinarian of Newark, it has for several years been a custom with dairymen in Essex County, and especially about Orange, to inoculate their herds, not only when there was an outbreak among their cattle, but as a customary precaution. It is worthy of note that all who have pursued this plan express themselves fully satisfied therewith, and aver that they have never known any case of the transmission of the contagion by this means. While much of this is negative testimony, and

may be partially set aside by saying that most of them would have escaped contagion without this, it is yet worthy of record that while there have been sporadic cases of the disease in Orange and adjacent localities, these have been no more numerous than at some other points. For over a year it has been the habit of the veterinary service of the State board of health of New Jersey to seek to eradicate the disease by slaughter if only one or two cases had occurred. But if there had been more extended seizures before notice, or if the disease threatened to spread, resort has been had to inoculation. Dr. J. W. Hawk, of Newark, and Dr. Leatherman, of Clinton, have had occasion thus to inoculate several herds. In about two hundred cases of inoculation they report that the results have been altogether satisfactory. Herds have been protected and the disease limited. While a few of the animals have lost their tails, and some have been for a little time quite sick, no deaths have occurred from this cause. Great care has been taken in the selection of the inoculating juice, and it has been generally introduced, by a seton of woolen yarn, into the muscle just beneath the skin of the tail.

While thus feeling our way on the basis of the authorities before alluded to, and by a cautious use of the method in general acceptance, the following series of cases occurred:

A farmer and dairyman having about thirty head of animals in his herd, and not having and never having had any cases of contagious pleuro-pneumonia among his cattle, was informed that two or three of his neighbors had the disease among their herds. He was a mile and a half distant from the nearest one. The cattle had not come near to each other by neighboring fields. He had no occasion to take any of his cattle to other yards, or to have any brought to his. He had not purchased an animal for three years. Not knowing the law of the State, he concluded to have his cattle inoculated by a veterinarian of Newark. His entire herd was inoculated in the month of December. One or two of these animals lost their tails, several were somewhat sick and recovered, and did not contract pleuro-pneumonia, though afterward exposed. On the tenth day after the inoculation two calves had convulsions and died. Three of the healthiest cows were taken severely sick with all the symptoms of contagious pleuro-pneumonia, and had to be slaughtered. *Post-mortem* examination left no doubt as to its being genuine contagious pleuro-pneumonia. Some of the other cows did not seem to recover their usual health or milk supply. A thorough examination four weeks later by H. W. Rowland, D. V. S., of Jersey City, and J. Gerth, jr., D. V. S., of Newark, showed conditions of lung that would indicate nothing else than contagious pleuro-pneumonia. As the cows were gaining, the owner was permitted to keep them, on condition that they should not be sold until fit for slaughter, and then not for any other purpose.

Here we have a series of cases in which either the veterinarian caused

the disease to the herd by person or fomites, or introduced it by inoculation. If the latter, it would seem to support the hypothesis of some, who, while admitting that the introduction of the virus into a muscle, instead of by the breath or into the lung, generally causes a milder disease, which is protective, yet that occasionally, under conditions not yet known, it will resume its malignant activity and light upon the organ which seems to afford its chosen nidus. It seems somewhat analogous to the old facts as to the inoculation for small-pox, in which undoubtedly the introduction of the virus into the skin or flesh instead of into the lung did modify and mitigate the disease. But in this it was a known fact that now and then a strange exception would occur, resulting in secondary fever and death. While single cases prove but little, and the mind must suspend its judgment until other cases occur, or until the occurrence is explained, it must be confessed that these cases were a restraint upon what had before seemed to us to be legitimate conclusions. The great asserted facts upon which the more recent hopes as to inoculation of cattle have been predicated are (*a*) that the virus thus introduced never causes any affection of the lung, and (*b*) that the animal that has been inoculated does not impart the disease to others.

In view of the immense interests involved, this Government should institute a series of experiments to settle this matter, and either arrive at the conclusion that systematic and rational extinction of the disease is to be secured by slaughter, or define how it can be aided or secured, if at all, by systems of regulated inoculation. Since the important experiments and deductions of Pasteur, Chauveau, Touissant, Koch, and many others, it seems almost imperative that this Government should, by systematized methods of histology, pathology, and laboratory investigations, and by the experience of skilled observers, determine the means of checking those marauding epizootics that imperil the health and life of so many millions of animals of various species, and with it imperil the industrial interests of all classes and the very life and health of a race so dependent on good meat and good milk for food.

FOOT-AND-MOUTH DISEASE.

We are fortunately dependent on foreign authorities for the most accurate descriptions of this disease. Unlike pleuro-pneumonia, it is readily communicable "to sheep, goats, swine, and poultry; it is easily transmitted to the human subject. It has been described as existing in the horse, dog, wild fowl, deer, wild boar, cat, &c." The milk of animals in many cases seems to have conveyed the disease to man, although some regard this as having occurred only when there were vesicles upon the udder or teats, the secretions from which had mingled with the milk. (Walley, Edinburgh, 1879.) The same author also speaks of it as "one of the most infectious and contagious maladies which affect domestic animals, and the easiest of transmission," and as remarkable "in the effect which the milk of animals affected with it

produces on their young and even the young of other species." Because of its rapid and diffusive contagion, and of the fact that one attack does not protect from another, that both the meat and milk supply are jeopardized thereby, it is probable that its actual losses to food products are greater than that of any of these pervasive plagues. Recently J. W. Stickler, M. D., of Orange, N. J., a physician who had become interested in the disease only because of its comparative relations and its partial similarity to certain aphthous diseases of children, procured from Professor Williams, of Edinburgh, some of the virus of the disease, and inoculated some calves therewith. The saliva was taken from a cow affected with the foot-and-mouth disease, and put into glycerine tightly corked in a bottle, and immediately forwarded to the doctor. In a recent note to the writer, Dr. Stickler says:

The history of this case is as follows: Alderney calf, two and one-half weeks old; before inoculation seemed perfectly well; visible mucous membranes free from any eruption and discharge; skin and interdigital spaces normal in appearance. I inoculated the animal by subcutaneous injection of the virus just posterior to the elbow joint and anterior to the stifle. Nothing at all positive developed till January 2, when the temperature rose to 104° 8 Fah. There was a discharge of quite tenacious mucus from the nostrils, and at various points upon the mucous membrane of each there were small papulae. The mouth was hot and red, although there were no distinct ulcers or aphthae. The nearest approach to an ulcer was an apparent thinning of the mucous membrane at one or two points. The saliva seemed to be increased somewhat in quantity. The howels were loose. A microscopic examination of the blood showed the existence of small round or oval bodies of a faint port-wine color. They had an activity which, I think, was independent of that caused by any motion of the blood plasma. To determine this point, I was careful to place upon the glass slide only a drop of blood, adjusting the cover glass with sufficient firmness to cause an even dispersion of the fluid. I then noticed that these little bodies seemed to have the power to move in various directions. The saliva and nasal discharge contained the monads spoken of in the various works upon "cattle diseases." I am not aware, however, that attention has been called to the existence of small, active bodies in the blood of animals affected with "foot-and-mouth" disease. The feet now became slightly reddened, but showed no blebs or ulcerations. There was also a little swelling just above the hoofs. The condition of the calf remained essentially as just given till January 10, when the feet became swollen to a marked degree and the redness more pronounced. In the interdigital spaces the skin was found to be loosened from its attachment, although there was no fluid to be seen. There was but little heat of coronets. The back of the animal was arched. The redness of the feet became more intense, the hair coming off, leaving quite large areas of uncovered red integument. The bowels again became loose, the animal feeding insufficiently, till, finally, on January 17, it died.

As seen by us the disease was in its subacute stages. One calf had just died of it. When the vesicles break, the red or scarlet surface becomes covered with a secretion, but shows little tendency to return to its normal condition. The emaciation of animals is rapid, both from the disease itself and the interference with feeding, which it causes.

We do not know of other experiments with the virus in this country. It is very certain that the most scrupulous vigilance should be exercised as to the disease, and that it should never be allowed to obtain a foothold here. There is no disease against which the veterinary inspector

in England watches with greater care. Our system of large herds and cattle ranches has no parallel in the cattle culture of the United Kingdom. Its spread here would, if it should get full headway, compare with that abroad as does the sweeping fire of the prairie with that of a city block, where the provisions for extinguishment are ready to the hand. Well may all owners of cattle urge the National Government to exercise its preventive discipline over importation and all movements of cattle from the seaboard, all the more because recently a new demand has sprung up in the West for young stock from the East. The transportation which has heretofore been toward the seaboard is now likely to be met by a counter-current to be inland west, since the stock-breeding there does not supply the demands which the fields of space in the middle land between the oceans provides for the feeding and fattening of young cattle.

We scarcely need to emphasize the application of the same precautions as to those diseases of swine and sheep which are equally destructive to these smaller flocks, and which alike imperil interests in which large capital and great commercial enterprises are involved. The census of 1880 gives as for the United States 10,357,488 horses, 1,812,808 mules and asses, 12,443,120 milch cows, 903,841 work oxen, 22,488,550 other cattle, 35,192,074 sheep, and 47,681,700 swine, or an aggregate of, or about, 131,000,000 in all. When we consider that the yearly increase is constant, we ought not to need extended argument to show that the sums expended in competent investigation and in skilled oversight of these interests, if honestly and intelligently expended, is among the very best investments the General Government can make. Perhaps the lack at present is more in competency of observation and in tried and successful methods of protection than in a recognition of the desirability of such oversight. But as a demand creates a supply we are already seeing Harvard University and the University of Pennsylvania with veterinary departments, Toronto and New York with worthy veterinary colleges, and the American Public Health Association giving it prominent consideration, the medical profession alive to its importance and co-operating here with something of the same spirit and ability with which in England the foremost member of the Royal College of Physicians and Surgeons is found conducting and aiding in investigations of a similar kind.

It is only by a combined and continued system of surveillance that we can hope to prevent or arrest the wandering epizootic pestilence or those enzootics which spring up in localities and are dependent upon causes which, although difficult of detection, are, in the light of the past few years, likely soon to be unraveled. By such a course, and by putting on record the facts and experience obtained by skilled local observers, we shall succeed in arresting or abating many of the vagrant diseases, and thus greatly appreciate both the wealth, the comfort, and the health of our people, and be able to furnish the markets of the Old

World with a surplus meat supply excellent in quality and abundant in quantity.

GLANDERS AND FARCY.

The disease known as glanders or farcy is so insidious in its character as to need most careful inquiry and inspection on the part of local, State, and national authorities. Unless large powers are given, the laws will be evaded and the disease perpetuated. This has been signally illustrated in a series of cases that have occurred in the South Orange car stables, in Newark, during the last year. There is reason to believe that over a year since a case of glanders occurred in those stables, which was claimed to have been cured. About August 1, 1883, the attention of the local boards of South Orange and Newark, and of the State, was called thereto through a legal process of inquiry. The disease was found so extensive that about sixty head of horses had to be killed. Not long after the veterinarian in charge, Dr. J. W. Hawk, of Newark, condemned three more. The owner consented at once to their destruction. There was delay as to one, which had the least external manifestation, and during the delay the owner, under unfortunate rival advice, concluded that the animal was sound. Afterward the certificate of the veterinarian was given to that effect. The State board of health and its veterinarian were refused entrance to the stable. Owing to alleged or possible defects in the law a new one was passed. It was not, therefore, until April that the board was again able to secure undisputed entry. On the first visit this horse was found with symptoms of glanders, and a *post-mortem* examination fully attested the former diagnosis. There were other suspicious cases, and it was found necessary soon after to condemn two more. The disease is now in such a chronic, and in some cases probably in such a concealed form, that it is claimed by some that nothing short of a destruction of all the live-stock and the buildings will eradicate it. Occasional cases are now occurring in other parts of the city. The whole history of these cases illustrates the persistent infection of the malady, and shows how delay by the interposition of legal obstacles may result in entailing upon an entire city the continuance of a disease which could have been eradicated in the start.

As there is much difference of opinion as to the possibility of the spontaneous development of glanders in stables where horses are overworked or illy kept, it seems very desirable that the General Government should institute a series of experiments and investigations for the purpose of determining this point. The disease is of a very threatening character to the great industries which so much depend on this class of animals. As, too, it is admitted that stables which have contained affected horses, and all the harness used come to be fomites or foci of communication, there is need of the most precise directions as to the choice of disinfectants and their accurate and successful use. It is doubtful whether this can be left to owners or even to the general vet-

erinarian. It is better rather to commit it to those who understand all the details of fumigation, inhalation, and the washing and saturation of all exposed surroundings and material.

Our experiences in this State for the past year with pleuro-pneumonia, glanders, and hog cholera are sufficient to emphasize the immense importance of close investigation of all contagious animal diseases by the General Government. There is need not merely of hurried inquiry into alleged outbreaks of contagions, and the rapid application of methods of isolation, destruction, or quarantine, but of scientific and laboratory investigations and such skilled observations and experiences as will prevent their occurrence. The notable results that have already occurred from the combined inquiry and insight of medical and veterinary experts into the general development and life-history of these marauding pestilences, is enough to assure us that our neglect will be culpable, if we fail to protect our great commercial and industrial interests by saving as far as possible the live-stock of our country from invasions as disastrous as those of pestilence and famine.

TRICHINIASIS.

[The following article on Trichinæ and Trichiniasis was contributed by Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, to the report of the Commission, of which he was a member, appointed by the President to investigate the condition of the swine industry, and the pork product of the United States. It embraces the researches which have been made in regard to this subject up to this time.]

EXTENT OF TRICHINIASIS IN AMERICA AND EUROPE.

This subject being, in the present attitude of certain foreign Governments in regard to American pork products, the most important of all the questions that have received our attention, we have given it a very careful consideration. The alleged frequency of trichiniasis in American hogs has been *the* reason insisted upon by the various countries which have prohibited the importation of such products; for, while it is true that other objections have been advanced, particularly in France, none of these have sufficient foundation in fact to stand the test of even a superficial examination. It is, however, not a question of the prevalence of trichiniasis here and its absence in other countries, since this parasite has been found infecting the hogs and other flesh-eating animals in the most widely separated portions of the earth. Dr. Manson examined 225 specimens of Chinese pork and found 2 or nearly 1 per cent. infected.* Dr. Wartable has described epidemics near the sources of the Jordan resulting from eating the flesh of the wild boar,† and in every European country in which inspections have been made a very considerable proportion of trichinous animals have been discovered.

Certain writers have pretended that the animals of France have never been affected with trichiniasis,‡ but this conclusion seems to have been reached without any investigations. A large proportion of the rats of Paris were long since found to be infected,§ and in 1879 a serious epidemic of trichiniasis, known as that of Crépy-en-Valois, occurred, in which sixteen persons sickened from eating the flesh of a native animal.||

That trichinæ also exist in America and infest a small proportion of American hogs is a fact that must be admitted, but it is a more difficult matter to compare the frequency of American and European infec-

* Imp. Customs. Med. Report, Shanghai, XXI (1881), p. 26.

† Lancet, August 4, 1883.

‡ J. Chatin: La trichine et la trichinose.

§ Davaine: Traité des entozoaires, &c., p. 755.

|| Gazette des Hôpitaux, February 20, 1879.

tion than has usually been supposed. American hogs have usually been examined by microscopists who were competent to do the work and who would not overlook a single case, while in Germany there has been an immense number of inspectors employed (18,581 in 1881), many of whom were utterly incompetent. An examination in 1877 showed that many of the microscopes were useless, that glasses used were too dirty to permit the examination, and that some of the inspectors were incapable of detecting the parasite.* Even as late as 1881 there were complaints in regard to the incompetency of inspectors, and the continued recurrence of trichiniasis among people from eating inspected meats demonstrates that these complaints were not made without reason.† Even the German inspections of American meats cannot be taken as a fair comparison with the average of their inspections of indigenous animals, for the reason that our meats are examined in their larger cities and by their most competent inspectors. It is absolutely necessary to bear these facts in mind, in considering the figures which are given as representing the results of the microscopic examination of American and European pork.

PROPORTION OF AMERICAN HOGS INFECTED WITH TRICHINIASIS.

The hogs in Dearborn County, Indiana, seem to be infected in a larger proportion than anywhere else in the country, or at least were in 1874. Drs. Harding and Robbins examined 245 animals slaughtered near Lawrenceburg, and found that 40, or $16\frac{1}{3}$ per cent., contained this parasite. This seems to be far beyond the average, however, even in this center of infection, for Drs. Gatch and Miller examined 200 animals at the same place and only found 13 infected, or 6.5 per cent.‡

In 1866 Belfield and Atwood are reported to have found 2 per cent. of the hogs slaughtered in Chicago infected, and in 1878 an examination of 100 animals at the same place indicated that 8 per cent. contained trichinæ.

From 1879 to 1881 Dr. F. S. Billings, of Boston, examined 8,773 hogs, of which 347, or 4 per cent., were reported as containing trichinæ.

Dr. Deveron, of New Orleans, inspected 5,400 hogs in 1881, of which only 22, or 0.4 per cent., were trichinous.§ Of these animals 529 came from Saint Louis, and among them were 18 infected ones, being 3.4 per cent.; 241 came from Louisville, and 2 of these, or 0.83 per cent., contained trichinæ; 484 from unknown parts of the West, had but 2 infected, or 0.4 per cent., while the remaining 4,146, mostly from the South, were free from this parasite.

Dr. C. A. Simpson examined 30 hogs at Atlanta, which were mostly

* Vierteljahrsschrift f. Ger., Med., &c., N. F. XXX, p. 175-181.

† Loc. cit. XXXVII, p. 345-351.

‡ A Report on Trichiniasis as observed in Dearborn Co., Indiana, in 1874. By George Sutton, M. D., Anrora, Ind.

§ Report of American Health Assoc., vol. 7, p. 136.

from Tennessee, without finding any infected, and Dr. R. W. Steger examined 180 at Nashville, Tenn., all of which were also free. Dr. William Myers examined 330 hogs at San Antonio, Tex., finding trichinæ in but 2, or 0.6 per cent.*

Dr. H. J. Detmers has examined from August to December, 1883, for the Department of Agriculture 3,331 at Chicago; of which 80, or 2.4 per cent., were found to be infected. Of this number 1,126 were from unknown districts of the West; 46, or 4.08 per cent., containing trichinæ; 50 were from Michigan, among which 4 contained the parasite; 831 were from Iowa, of which 19, or 2.27 per cent., were infected; 50 were from Dakota, of which 1 was infected; 520 were from Illinois, among which were 7, or 1.35 per cent., containing trichinæ; 304 were from Wisconsin, with but 2 infected, or 0.66 per cent.; 350 came from Nebraska, having but 1 infected, or 0.28 per cent.; 100 were from Minnesota, and were free from infection.

In the laboratory of the Department of Agriculture specimens from 300 hogs have recently been examined, and of these 5, or 1.66 per cent., were found to contain this parasite.

We have above the records of the examination of 18,859 hogs from various parts of the United States, of which 517, or 2.7 per cent., contained trichinæ. It is evident from these records that a considerable proportion of the hogs from some sections of the country are trichinous, while those from other sections are practically free from infection. While it may be difficult to outline the trichinæ districts and to trace the infected animals to the farms on which they were raised, it is believed that such a study would do much to clear up the origin of this infliction.

In addition to the inspections detailed above, Drs. Osler and Clement examined at Montreal 1,000 hogs from Western Canada, finding 4 infected.† The French inspectors report the examination of 103,528 pieces of American meat, containing 2,080, or about 2 per cent., infected.‡ The German inspectors, during the year 1880, examined 78,880 pieces of American pork, of which we have record, and found 1,265, or 1.6 per cent., to contain trichinæ; and in 1881 they examined 96,485 pieces, finding trichinæ in 2,414, or 2.5 per cent.§

Taking all the examinations of American pork thus far made, both at home and abroad, and we have a total of 298,782, during which trichinæ were found 6,280 times, being 2.1 per cent., or 1 to 48.

It would seem that this number of pieces, considering the close agreement between the results reached by American microscopists over this limited territory and those obtained by the inspectors of American pork

* Report of American Health Assoc., vol. 7, p. 138-145.

† An Investigation into the Parasite in the Pork Supply of Montreal; 1883, page 6.

‡ Chatin, *La Trichine et la Trichinose*, Paris, 1883, page 217.

§ H. Eulenberg. Ueber die im Jahre, 1881, auf Trichinen und Finnen untersuchten Schweine. Vierteljahrschrift, f. Ger. Med., &c., 1882.

in Europe, perhaps represents the condition of American pork so far as examined.

In Europe there are some localities where the inspections have shown a greater proportion of infection than the average in the United States. At Stockholm 2,000 hogs contained 58 infected ones, or 2.9 per cent.; at Tannefors 300 hogs contained 10 infected ones, or 3.3 per cent.; and in 112 Bavarian hams 3 were trichinous,* while Dr. Rine, of Linten, reported 4 infected animals in 45, or nearly 9 per cent.† In Prussia, where the only really effective inspection is made, the proportion found infected with trichinæ was, in 1876, 1 to 2,000; in 1877, 1 to 2,800; in 1878, 1 to 2,000; in 1879, 1 to 1,632; in 1880, 1 to 1,460; in 1881, 1 to 1,839; in 1882, 1 to 2,056 ‡ The number of inspectors in 1882 is placed at 20,140. Several inspectors at Erfurt were removed on account of incapacity, and complaints were made as to the condition of the microscopes. Indeed, it seems that the village barber is usually trusted with the inspection of hogs in the smaller towns and villages, and that he is required to make but three preparations from each animal.

Frequently, or generally, the specimens for examination are taken from the hams and hard muscles, where the trichinæ are least abundant, instead of from the pillars of the diaphragm and tenderloin, where they are most easily found. Since the great epidemic of trichiniasis in Saxony it seems to be admitted that these inspections are totally inadequate, and in order to make them more efficient the magistrates have awarded sums varying from 15 to 30 marks for each trichinous animal discovered. As a result of the rewards, and possibly of the fear excited by the recent terrible outbreaks of the disease in people, an increased number of infected hogs seem to have been discovered.§ These facts, as well as the extraordinary number of people recently infected from eating pork which had been inspected, are sufficient to demonstrate that large numbers of trichinous hogs pass the inspectors without being discovered, and that consequently the figures given above are not a correct representation of the proportion of hogs which are infested with this parasite.

In nearly every country of Europe hogs have been examined and a certain number found to contain trichinæ, but the records do not seem to have been carefully kept; the data are not fully given, and there is reason to doubt the accuracy of the work. It is difficult, therefore, to reach any satisfactory conclusion as to the proportion of infected hogs. We may safely assert, however, that no country can with reason claim that its hogs are free from trichinæ, while the probability is that Eu-

* Warfwinge, Nord. Med. Ark., 1875, VII, 3, No. 18.

† Meissner, Schmidt's Jahrbücher, No. 130, page 113. Quoted by Glazier Rep., page 65.

‡ H. Eulenberg, Vierteljahrsschrift f. Ger. Med., 1877 to 1883.

§ Dispatches of A. A. Sargent, American minister at Berlin, to State Department, dated October 26 and November 12.

ropean hogs generally are infected in a much larger proportion than is at present admitted.

In some parts of Europe rats seem to have been examined more carefully than pigs; thus in Saxony one-half of the rats from flayers contain trichinæ, and 20 per cent. of all those caught are similarly infected; in Moravia sixteen out of one lot of twenty rats were infected, nine of a second lot of twelve were infected, seven of a third lot of eight were infected. In Klederling, a suburb of Vienna, seven out of forty-seven, and at Untermeidling two out of thirty-one were infected.* In France, where the authorities now deny the existence of trichinæ, except as imported, and where one of the reasons for prohibiting American pork is the alleged fear of scattering this parasite over the country,† the only outbreak of trichiniasis on record was caused by the flesh of a native hog; and the rats from the ditches and sewers of Paris, examined by Drs. Goujon and Legros, were infected in very large proportion; one lot of thirty-two contained three with trichinæ, and of seventy-two rats, five were full of these parasites.‡

EFFECT OF THE CURING PROCESS ON THE TRICHINÆ.

If we admit that about 2 per cent. of American hogs contain trichinæ, it becomes a matter of the greatest importance for us to inquire into the condition of the parasite after it has been subjected to the action of salt a sufficient time to enable the pork to be carried from the packing-houses in this country to the consumers abroad. And here the effect on the consumers is entitled to more weight as a matter of evidence than those scientific experiments which are simply designed to prove the life of the parasite; for the trichina may sometimes still be living but not have sufficient vitality to develop and reproduce itself. Such trichinæ would be perfectly harmless even though the pork were eaten without previous cooking.

In France it is said in the report of Academy of Medicine of Paris, that 95,000,000 kilograms or 200,000,000 pounds of American pork products had been consumed from 1876 to 1881 without causing a single case of disease. And notwithstanding the fact that large quantities of such pork have been consumed for a number of years, the one outbreak of trichiniasis at Crépy, which was clearly traced to a French hog, is the only instance of the appearance of this disease among people that is recorded in that country.

In Germany, where it is the habit of the people to eat pork without cooking, trichiniasis among people is common, and it has been very frequently asserted in some quarters that many of these cases were due to American pork. During the recent terrible epidemic at Emersleben and neighboring towns, Dr. Brouardel, of the Paris Academy of Medi-

* Dr. Glazier, Report on Trichinæ and Trichiniasis, Washington, 1881.

† J. Chatin, Trichine et Trichinose, p. 153, foot-note.

‡ Thèse de Paris, 1866, and Davaine, Traité des Entozoaires, p. 755.

cine, went to Prussia to investigate the origin and nature of the disease and learn what he could in regard to the healthfulness of American pork. Not only did he find that these particular cases of trichiniasis were due to German hogs, but such eminent and well-known authorities as Professors Virchow and Hertwig, who have charge of the pork inspection at Berlin, asserted most positively that no case of trichiniasis in Germany had ever been clearly traced to American pork, although the people, as is their habit, persist in eating it raw.*

The so-called outbreak of trichiniasis on board the English reformatory school-ship Cornwall has been much quoted as illustrating the danger of American salted pork, but when closely investigated it proves to be an illustration of jumping at conclusions without evidence, as always seems to have been the case where trichiniasis has been attributed to our meats. This outbreak of disease occurred between September 23 and October 23, 1879, and forty-three boys were attacked out of a total of two hundred and sixty-two boys and fifteen officers on the ship. The idea that the disease was trichiniasis seems to have been an afterthought, for the only examination made was of the body of one of the boys two months after it had been buried. Doctors Powell and Cory thought they found trichinæ in the muscles, and concluded the disease must have originated from the American pork, which was used on board the ship; but no examination of this pork appears to have been made, and we are not at all certain that English pork was not used as well. Fortunately, specimens taken from the corpse were submitted for examination to that well-known scientist, Dr. Charlton Bastian, and he pronounced the worms not trichinæ at all, but a hitherto unknown nematoid, which he classed with the genus *Pelodera*, calling the species *Pelodera setigera*. Dr. Cobbold, who is one of the very best authorities on this subject, asserts very positively that the worm was the *Pelodera teres*, and had probably invaded the body after death.† As this worm has never been known to exist as a parasite in the hog, the assumption that the disease was produced by eating pork is an entirely gratuitous one, and the further assumption that it was due to the American pork is evidently without the least foundation.‡

England has been one of the largest consumers of American bacon, hams, and pork, taking even in 1880 and 1881, when this trade reached its largest proportions abroad, five times as much as either France or Germany. Belgium has also been a large consumer. The *Comité consultatif d'hygiène publique de France* said in a recent official report that in order to determine the danger from the use of American pork they had recently made new inquiries in England and Belgium. In England they were told that trichiniasis was so completely unknown that it was

* P. Brouardel, L'Epidémie de trichinose d'Ermsleben. Bul. de l'Acad. de Méd., Paris, 1883, p. 1501.

† Veterinarian, 1884, p. 4.

‡ Power, W. H. Outbreak of Fever proved to be Trichiniasis on board Reformatory School-ship Cornwall. Rep. Med. Off. Local Gov. Bd., 1879. London, 1880.

never mentioned, either in the newspapers, the hospitals, or in teaching medicine. And this was also the case in Belgium.*

We may conclude, therefore, that notwithstanding the enormous quantity of American pork which has been consumed in Europe, there is no reliable evidence that any cases of trichiniasis have ever originated from its use.

We can now consider more intelligently the conflicting testimony in regard to the condition of the trichinæ in American salted meats when they reach Europe. In 1879 it was stated in the German reports that although a very considerable number of examinations had been made at Minden, no living trichinæ had been demonstrated in preparations of American pork.† This statement was repeated in 1880 by the same authority.‡ In France, Colin and most others who have experimented with the trichinæ of American meats have found them dead and incapable of producing any injurious effects when fed to other animals. It was also found that even slight salting killed all the trichinæ within two months. Colin concludes, therefore, that the danger from eating American pork, considering the time that it must have been in salt before it can reach Europe, is slight or inappreciable.§ Fourment|| and Chatin¶ have contested these results, but their opinions are so extremely radical as to lose much of their force on this account. It is not impossible that in certain very rare cases the capsules containing the trichinæ may have become so dense or so impregnated with lime salts as to protect the parasites for a longer time than usual against the action of the brine; but the complete innocuousness of our pork as demonstrated by its use on so large a scale in England, France, Belgium, and Germany, with no cases of disease clearly traced to it, is the strongest possible evidence of the destruction of the trichinæ during the process of curing.

Dr. Brouardel, of the Paris Academy of Medicine, who investigated the recent outbreaks in Ermsleben, has furnished new and very important evidence on this point.** He learned that the meat of the diseased hog was chopped and mixed with sufficient salt to preserve it, and those who ate of this meat soonest after the killing of the animal were not only more severely affected, but their symptoms appeared in a shorter time. The animal was killed the 12th of September, and of those who partook of this meat on the 13th 33 per cent. died, while of those who did not eat of it until the 18th and 19th none died. In fact, there was a very regular graduation in the intensity and fatality of the cases when they were classified according to the number of days which

* H. Bouley, *Bul. de l'Acad. de méd.*, Paris, 1884, p. 33.

† Eulenberg, *Vrtljhrsch. f. ger. méd.*, 1879.

‡ *Loc. cit.*, 1880.

§ G. Colin, *Comptes Rendus*, xvi (1882), 886-'8.

|| L. Fourment, *Comptes Rendus*, xciv (1882), 1211-'13.

¶ J. Chatin, *La Trichine et la Trichinose*, Paris, 1883, 164-190.

** Brouardel, *Bul. de l'Acad. de méd.*, 1883, 1501.

had elapsed between the killing of the animal and the eating of the meat. It was very evident that the parasites were rapidly losing their vitality and their power to produce disease. M. Colin thought this was due to the effects of the slight salting, and M. Brouardel seemed willing to admit this.

If, then, so marked a result is produced in a single week by the slight salting which this chopped meat received, it is very plain that the high degree of salting to which our packed meats are subjected must be sufficient in the vast majority of cases to completely destroy all trichinæ and to make the meats perfectly safe. The question cannot be narrowed down for this reason to a comparison of the proportion of animals affected with trichinæ in America and Europe, even if this were actually determined, which is not the case, but it necessarily turns on the healthfulness of the meats of these countries at the time when they are offered for consumption. And when the matter is viewed from this stand-point the very great superiority of American salted meats over even the inspected German hogs is too apparent to be questioned by unbiased scientific men.

In the latest discussion on this subject in the Paris Academy of Medicine M. Proust said :

The question is not a determination if American meats contain trichinæ, but in what condition these trichinæ are found; if they are alive or dead; if they are injurious or not; in a word, if the consumption of American salted meats is dangerous or not to the public health.

In this connection I ask permission of the academy to read a passage from a most interesting letter that I received this morning from Dr. Gibert, a health officer and distinguished sanitarian of Havre :

"In 1881," says M. Gibert, "American salted meats entered largely into the food supply of the working class of Havre; but in regard to this it is important to divide the consumers into two classes :

"1. The people buying American salted meat for family consumption always cooking it and never eating it raw. The inhabitants of the quarters of Eure and Saint François nourished themselves exclusively with it.

"2. The workmen employed in handling the packages of salted meat, who during fifteen years continued to eat this meat raw. MM. Bouley and Chatin could easily have seen in their walks on the wharves of Havre workmen breakfasting on a piece of bread and a slice of raw bacon, eating not only the fat but all parts of the meat. Any one could repeatedly see these workmen day after day, even when at work, eating pieces of raw salt pork without fear.

"It is certain, then, that at Havre, for more than fifteen years, hundreds of workmen consumed salted meats trichinuous as well as not trichinuous, and never during this long period of years has a single workman been incommoded by this food.

"No physician in Havre has seen a disease resembling in the least the Ernleben disease described by MM. Brouardel and Grancher. Such an assertion demands some proofs which it is easy for me to give.

"I would remark, in the first place, that if the meat consumed raw had affected the health of the workmen employed in such large numbers handling salted meats the directors would have soon discovered the vacancies in the ranks of the workers. After an investigation carefully made by me, and which it is easy to make anew officially, it was found that never had there been a knowledge of such a fact in any of the large importing houses of Havre.

"The workmen, after the arrival of the Paris savants, took pleasure in eating the pieces themselves that were pronounced trichineous, so certain were they of their perfect harmlessness. And neither during the stay of these gentlemen at Havre nor afterwards was there a single case of disease, or even a simple indisposition.

"In the second place, I would remark that during this period of fifteen years we have had no serious epidemic of typhoid fever. That of 1880-1881, the only one at all serious which has occurred in our city, affected the quarters occupied by the well-to-do or rich people, while the quarters where the American meat was consumed suffered very little. There was then no possibility of an error on the part of the physicians, even if such a gross error could have been committed.

"It follows, from the facts that I have just related, that the salting of American pork is sufficient to kill the trichinæ; and if, in addition to this cause of security which has been experimented upon by the workmen of Havre for fifteen years, we add the cooking, as it is practiced everywhere in France, the conclusion is forced upon every one not prejudiced in advance that American salted meats are absolutely incapable of producing trichiniasis in the consumers."

the same discussion M. Leblanc said :

The discussion appears to me exhausted; however, I ask permission of the academy to communicate in support of the note of Dr. Gibert the following observation. It was furnished to me by the principal meat inspector of Paris:

The veterinarians under his direction examined during six months in 1881 5,000 kilograms (11,000 pounds) of American salted meat per day. Sixty thousand kilograms were seized as trichineous, and a large part was shipped to England. During these six months the employés and draymen of the dealers in salted meats who came to the station of Batignolles ate meat in presence of the inspectors which was notoriously infected with trichinæ. Not one of them became sick.

One of these, M. R., employed by Calman, 11 Rue Bergère, was accustomed to this, and took pleasure in eating the parts of the pork in which the microscope had demonstrated the presence of trichinæ. To-day, after three years, he is well; more than this, having been received at Beaujon as a patient of our colleague M. Tillaux, for a fractured arm, and having related his bravado, he was the subject of a special examination; his muscular tissue was recognized to be healthy, and no trichinæ could be found in it.*

EFFECT OF COOKING ON TRICHINÆ.

If the trichinæ of American pork are destroyed by the curing process in a time much shorter than is necessary for such meats to be shipped from our packers to any of the consumers in Europe, it may seem superfluous to go into a consideration of the effect of cooking, and yet it is not wholly so. Under certain conditions it would appear that the trichinæ do resist the curing process for a considerable time; and though these conditions occur so seldom that uninspected salted meats are much safer than inspected fresh ones, it is still worth our while to inquire if perfect safety against infection cannot be guaranteed where a reasonable degree of cooking is practiced.

There is some conflict of opinion as to the temperature necessary to destroy trichinæ, and yet the results of experiments do not differ so widely. Vallin† concluded that a temperature of 54° to 56° C. (129 to

* Bulletin de l'Académie de Médecine, 1884, No. 6 (February 5), pages 241 and 247.

† E. Vallin. De la résistance des trichines à la chaleur et de la température centrale des viandes préparées. Rev. d'hyg., Paris, 1881, III, 177-182.

133° F.) kills most of them, and that 60° C. (140° F.) is safe. Fiedler's experiments show that trichinæ are quickly killed at 62.5° C. (144.5° F.) Fjord's investigations show that the interior of a ham weighing 8 pounds reaches 65° C. (149° F.) after boiling two hours and seventeen minutes; one weighing 10 pounds, after three hours and six minutes; one weighing 14 $\frac{3}{4}$ pounds, after four hours and eleven minutes; and one weighing 16 pounds after four hours and thirty-seven minutes. Vallin found that a ham weighing 12 pounds had an interior temperature of 65° C. after three and a half hours' boiling. These results, therefore, correspond very closely. Hein* found that a 2.2 pound roast reached a temperature in its interior of 69° C. after one and a half hours. Rupprecht observed that rapidly fried sausage only had an interior temperature of 53.5° C., and was still capable of producing infection. Colin† had a steak weighing half a pound boiled for ten minutes, when its appearance on cutting was white, without any red points. It still contained living trichinæ, however, which, being fed to a bird, were afterwards found developed in the intestine.

The indications from these experiments are that while fresh meats may not always be cooked sufficiently to kill trichinæ, salted meats are almost invariably cooked for more than the necessary time. This conclusion seems also to be borne out by the experience of people in all parts of the world. Trichiniasis from cooked meats is an exceedingly rare disease. In the United States, where pork in its various forms is consumed to as large an extent as in any part of the world, and where more than one-fourth of the hog product of the world is eaten, it is seldom, indeed, that we hear of any infection among our native population, because the habit of eating raw meats, particularly when fresh, does not prevail. The few cases which occur from time to time are nearly always among Germans and are traced to the ingestion of pork in some form, which has not been cooked at all.

In this connection Dr. Brouardel brought out a very interesting fact in his investigation of the epidemic at Ermsleben. No cases of disease occurred there except with those who ate the meat raw. The family of Herr Heine, the mayor of Ermsleben, consisting of five persons, consumed some of this same meat in the form of sausage on the 15th of September. The sausage was cut in pieces about 1 $\frac{1}{2}$ inches in diameter and was cooked by placing in boiling water for only five minutes. Not one of this family suffered in the least degree, but the cook who ate a small piece of the sausage before it was cooked contracted the disease. Boiling for so short a time has never heretofore been considered sufficient to destroy this parasite, and yet in this instance it undoubtedly protected the consumers from the infection.

At the session of the Paris Academy of Medicine, January 29, 1884, a report was presented by the special committee appointed to consider

* C. Hein. Rep. of a case of trichiniasis, with remarks on diagnosis and prophylaxis. Mitth. d. Ver. d. Aerzte in Nied Pest, 1883.

† G. Colin. Sur les trichines. Bulletin de l'Acad. de méd., 1881. 243.

(1) the report of M. Brouardel in regard to his mission to Ermsleben, (2) the communication of M. Grancher on the symptoms and pathological anatomy of the epidemic of Ermsleben, and (3) a letter from the minister of commerce asking the advice of the academy in regard to the question of trichiniasis. In this report appear the following points of interest:

A considerable invasion of German rats has been noticed of late years after the freezing of the Rhine, and M. Brouardel no longer sees the same species of rats at the morgue that he formerly found there. M. Laboulbene and M. Colin had occasion to observe quite a large number of trichinous rats that had been found in the sewers of Paris. Finally, we are also invaded by the trichinæ which penetrate France with the German hogs, which are infected in the proportion of 1 to 1,000 to 1 to 2,000.

Without doubt we do not know precisely, scientifically, the degree of activity of the trichinæ according to the time that they have been encysted in American meats, their vigor, the condition of the meat and the stage of the curing—desiderata which future experiments can alone supply.

The same ignorance exists in regard to our own hogs—are any of them trichinous? If so, what proportion? What is the condition of those in the suburban zone surrounding Paris which, nourished like the sewer rats, may be trichinous like them?

It remains for us to speak of the action of American salted meats in the production of the epidemics of trichiniasis in Germany which have been observed at Dusseldorf, Rostock, and Bremen, but our information in this respect is entirely insufficient, and according to the indications that M. Brouardel has already presented to the academy the exotic origin of these epidemics is denied by several of the principal German savans, and particularly by M. Virchow. Our Government might address the German Empire in regard to this in order to have official documents; but the results of such an inquiry have for us, from the standpoint now under discussion, an almost secondary importance. If in fact we, like the English and the Belgians, have been free from epidemics of trichiniasis although we received salted trichinous meats and even fresh or slightly salted pork of German origin more dangerous than that which comes from Chicago or Cincinnati, since it had only to cross the Rhine and the Vosges, this is because our culinary habits are entirely different. Let us remark also that in America it is above all the Germans who are affected with trichiniasis—an additional proof of the effect of culinary habits.

But already we can conclude from the developments which precede that no case of trichiniasis having been noticed either in France or in England from the consumption of American salted pork, the importation of these meats may be authorized in France. This decision has been reached by the commission by a vote of 5 to 1.

At the same session of the academy M. Lunier presented the following table, showing the importation of salt-pork products for eight years, in kilograms:

Year.	United States.	England.	Germany.	Other countries.	Total.
1876	3,269,960	1,875,736	702,530	1,047,920	7,896,146
1877	12,462,078	1,889,905	994,334	1,078,505	16,424,722
1878	28,102,290	1,454,884	921,167	1,314,437	31,792,778
1879	31,784,913	1,107,691	1,039,673	1,742,854	35,675,131
1880	34,246,195	1,233,228	846,174	2,387,671	38,713,268
1881	17,123,767	686,525	723,465	1,182,474	19,716,231
1882	4,611	1,109,870	1,055,783	1,074,259	3,244,523
1883	52,396	.....	1,136,793	2,091,779	3,274,966

It follows from this table that the importation of American salted meats, which had augmented rapidly from 1876 to 1880, began to diminish in 1881, after the decree of February 18, 1881, which prohibited the importation of salted meats from the United

States into all the French territory. The 4,611 kilograms which appear in the year 1882 came from a stock taken from the warehouses December 31, 1882. The 52,396 kilograms of 1883 were introduced after the promulgation of the decree of November 27, 1883, which removed the interdiction.

The same gentleman presented the following table, which shows the number of live hogs imported into France in the years 1877 and 1882; and the countries from which they came :

Countries.	1877.	1882.
Germany	15, 983	16, 165
Belgium	57, 806	68, 716
Spain	4, 234	2, 204
Italy	66, 366	9, 567
Switzerland	964	1, 586
Other countries	941	913
Total	146, 294	99, 148

In this connection he remarked, "It is then, to-day, Belgium and Germany which furnish us the greatest number of living hogs. Is it not from this direction that there is reason to fear the invasion of trichinae and trichiniasis?"*

TRICHINIASIS IN AMERICA AND EUROPE.

The number of cases of trichiniasis occurring among people in the United States is actually very small. The records of these have not been brought together in a thorough manner, but, as far as we have been able to ascertain, the disease has never occurred in more than three or four localities in a single year, and during the last twenty years there does not appear to have been more than thirty different outbreaks. In none of these outbreaks have a sufficient number of people been attacked to allow of the term epidemic being applied to them in any proper sense of the word. Usually but two to four people have been affected at a time, and never, so far as we have been able to learn, more than ten. All have resulted from eating raw or very imperfectly cooked meat, and in very few of the instances had the pork undergone any preliminary curing. Some of the cases reported as trichiniasis were never demonstrated to be this disease, but seem to have been the result of poisoning by meat which had been preserved without sufficient salting until it had undergone partial decomposition. It has long been known that extremely virulent poisons are produced during putrefaction of flesh, and the effects of these have been observed so often in Germany when sausages were eaten that they have received the special name of *wurstgift* or sausage poison. This does not seem to be understood by many American physicians, and so nearly every case of sickness arising from the consumption of the raw or imperfectly cooked flesh of hogs in the various forms in which it is preserved is reported as trichiniasis. So that while it may be true that some cases have not been reported or brought

* Bulletin de l'Académie de Médecine, 1884, pp. 189-211.

to our notice it is equally true that not all the cases reported as trichiniasis were really due to trichinæ.

In the debate which occurred in the French Senate June 20, 1882, M. Festelin referred to seven epidemics produced by American pork.* One of these so-called *epidemics* consisted of a single case of the disease which occurred in New York. Another was the disease on the English ship Cornwall, which was at first supposed to be typhoid fever, and was only decided to be trichiniasis when a body was exhumed two months after burial, and worms, which the examining physician took to be trichinæ, were found in the muscles. But we have it on the very best authority that these worms were not trichinæ, and there is no evidence even that they caused the disease. The most probable theory is that they gained access to the body after burial. No trichinæ or other parasites were found in the American meat consumed on this vessel.

Another epidemic he referred to as having occurred at Bremen, in which forty persons became diseased from eating an American ham. M. Chatin has mentioned this outbreak again and again, and insists that it is a demonstration of the dangerous character of American meats. The charge was so serious that it has been investigated as carefully as possible. M. Testelin does not give the authority who is responsible for this statement, nor does he so much as say in what year the outbreak occurred. M. Chatin is more definite, however, and says the disease was observed in 1875.† He refers to the *Traite d'hygiène publique et privée*, by Pronst, published in 1877, as his authority for asserting that forty persons were affected at this place as the result of eating an American ham. By consulting the yearly health report of Bremen for 1875 we find that no cases of trichiniasis in man are recorded during that year. There is simply a statement that two trichinous hogs (native animals) were discovered near Bremen. The outbreak of trichiniasis referred to by Testelin and Chatin seems to have been one that occurred at Hastedt, near Bremen in 1874, during which forty-two persons suffered, but all recovered. This epidemic was first announced August 15, and was caused by eating the flesh of a hog that had been slaughtered July 31. The diagnosis was confirmed by microscopic examination of a piece of muscle from one of the sufferers.‡ There had been a habit here, as in most other parts of Germany, of attributing all cases of this disease to American pork without investigation, and this may have been the origin of the story so industriously circulated by M. Chatin. At all events, this is the only extensive epidemic of trichiniasis which is recorded as occurring at or in the vicinity of Bremen from 1873 to 1877, inclusive, and there is no question but that this was caused by a native animal.

One of the other epidemics referred to occurred in Madrid, and an-

* Chatin, *La Trichine*, &c., p. 210.

† Chatin, *La Trichine*, &c., p. 165.

‡ Dritter Jahresbericht über den öff. Gesundheitszustand, &c., in Bremen, in Jahre 1874.

other in Liege, in Belgium. It is doubtful if in either case the trouble was traced to our pork; but no facts in regard to them have yet been obtained.

M. Chatin, in his recent work on trichinæ and trichiniasis, states that "such is actually the frequency of trichiniasis in the United States that the newspapers consider themselves happy if they have but a few deaths to record each week." Whether any one in France believes this remarkable exaggeration may be considered questionable, but still it is seriously advanced by a scientific man as a reason for prohibiting our pork. Those who see the American papers know very well that not only weeks but months elapse when no deaths are recorded from this cause. And if it were not for our foreign population, who have brought with them their dangerous habits of eating uncooked pork, America would be as free from trichiniasis among her people to-day as is France.

When we examine the records of Germany, however, we find that, in spite of the small proportion of infected hogs which they admit, in spite of the inspection, there occur a very large number of cases of this disease. In 1877 there were 16 in Königsberg, 1 in Potsdam, 6 in Berlin, 98 in Stettin, 1 in Oppelu, 61 in Merseberg, and 52 in Minden. In 1878 there were 27 in Königsberg, 8 in Marienwerder, 102 in Potsdam, 50 in Stettin, and 30 in Merseberg. In 1879 there were 55 cases in Königsberg, 93 in Frankfort-on-the-Oder, 82 in Berlin, 7 in Marienwerder, 3 in Schleswig, 60 in Erfurt, 7 in Merseberg, and several in at least three other places. In 1880 there were 149 in Merseberg, 83 in Erfurt, 49 in Frankfort-on-the-Oder, 3 in Marienwerder, 29 in Königsberg, and 16 in Berlin. In 1881 there were 3 in Marienwerder, 15 in Berlin, 10 in Frankfort-on-the-Oder, an indefinite number in Posen, 4 in Stettin, 148 in Merseberg, and 58 in Erfurt. In 1882 there were 3 cases in Berlin, 60 in Cologne, 4 in Merseberg, 4 in Heiligenstadt, and several in Posen.* In 1883 the remarkable epidemic in Saxony occurred from eating pork which had been slaughtered and inspected in the town of Ermsleben. In Ermsleben 257 persons contracted the disease, and 50 died.† In Deesdorf there were 40 cases and 9 or 10 deaths; in Nienhagen 80 cases and 1 death. There were a number of other epidemics during the year, the statistics of which have not yet been published, but we have already recounted sufficient to show that trichiniasis is incomparably more frequent in Germany than in America.

Indeed, for the seven years from 1877 to 1883, inclusive, the very incomplete statistics given above show that 1,835 people contracted the disease, being an average of 262 cases per annum. When in addition to this we consider that the United States is really the greatest pork-eating nation in the world, that we consume more than four times as many hogs as are raised in Prussia, that a considerable portion of our population consists of Germans who retain their habit of eating raw pork,

* Eulenberg, *Vrtljrscht. f. ger. Med.*, N. F., XXVIII-XXXVII.

† *Deutsche med. Woch.*, 1884, No. 1, p. 7.

the wonder is, not that we have a half dozen or a dozen cases of trichiniasis in a year, but that we do not have many times this number; and we see no way of explaining the comparative immunity which our people enjoy except by the conclusion that our pork, even when fresh, is not so much more dangerous than the German article as the results of microscopic examination thus far published would lead one to suppose.

REPORTS OF BOARDS OF HEALTH.

The commissioners prepared and forwarded copies of the following circular letter to the various State and city boards of health:

With a view to ascertaining the extent to which trichiniasis prevails in the United States, the following questions have been formulated, to be addressed to the secretaries of the various State and city boards of health.

As it is desirable that the report of the commission should be presented to Congress at once, the undersigned would beg as speedy a response as possible:

1. How many cases of trichiniasis have come to the knowledge of your board? Please give dates as far as practicable.
2. In how many cases was there a microscopic identification of the trichinæ in the human subject and in the suspected meat?
3. How many of the cases were fatal?

Responses have been received from thirty-nine of these boards; of this number twenty-two give negative replies; they were as follows: Alabama, Arkansas, California, Delaware, District of Columbia, Kentucky, Louisiana, Maryland, Minnesota, Missouri, Albany (N. Y.), Ohio, Pennsylvania, Rhode Island, Tennessee, and Virginia.

The secretary of the State board of Alabama says that no case has ever occurred in that State, though infected meat has been reported.

The secretary of the health department of Maryland says that after an examination of the records from January 1, 1834, to December 31, 1883, covering a period of fifty years, he finds no cases of trichiniasis reported.

The health officer of Cleveland, Ohio, says that in 1872-'73 there were some cases of trichiniasis reported in that city, but no definite record of them can be found.

CASES OF TRICHINIASIS REPORTED.

Cases of trichiniasis are reported by the following boards, viz:

Connecticut.—Three in 1882, all from the same pork and at the same time. The suspected meat was examined by Mr. C. W. Chamberlain, of Hartford, secretary of the board, and others. No deaths resulted.

Illinois.—The registrar of vital statistics for the city of Chicago says:

Three deaths from trichiniasis have occurred in this city within the last ten years. Two of these occurred in December, 1880, and the last one in January, 1882. There was a microscopic identification in the two first cases and probably also in the last.

The secretary of the State board of health says:

Between 1866 and 1881 there had been seven outbreaks of trichiniasis in Illinois, resulting in eleven deaths out of some seventy or eighty cases. Since 1881 there have

been two deaths in Chicago; three outbreaks, resulting in three deaths, and some twenty-five or thirty cases in 1883, and one in Fulton County in 1884, details of which have not yet been received. In nine of the fatal cases the disease was identified by microscopic examination of the human subject, and of the suspected meat in all cases.

Iowa.—The Secretary of the State board of health reports as follows:

Since 1880, in compiling deaths, I have found 3 recorded as from trichiniasis; in 1880, 2 in Adams County, probably genuine cases; in 1881, 1 in Butler County, a very doubtful case. None of the cases were identified by microscopic examinations.

Massachusetts.—The health officer for the State board of health for Massachusetts says:

The number of cases of trichiniasis that have come to the knowledge of the board are as follows:

	Cases.
In Saxonville, Mass., February, 1870.....	3
In Lowell, Mass., March, 1870.....	6
In Framingham, Mass., December, 1872.....	3
In Becket, Mass., May, 1873.....	4
In Wakefield, Mass., March, 1880.....	3
Total number of cases.....	19

One death occurred in the outbreak at Saxonville.

Identification of trichinæ was made in the fatal case at Saxonville by *post mortem*. In the Lowell cases trichinæ were identified in the pork, as also in the Framingham cases. In the seven remaining cases at Becket and Wakefield the evidence was symptomatic and by exclusion, *i. e.*, members of families who had not partaken of uncooked pork were exempt from infection. The evidence, however, was satisfactory to the board.

Michigan.—The secretary of the State board of health of Michigan gives the following detailed report of ten outbreaks of trichiniasis in that State since December, 1866:

1. A fatal case of trichiniasis occurred in Detroit, Mich., in December, 1866. Upon *post mortem* examination large numbers of trichinæ were found in the abdomen and a lesser number in the muscles of the leg. (Dr. Herman Kiefer.)

2. Five cases occurred in Port Huron, Mich., in January, 1874, with 2 deaths. The cases occurred in one family, and were caused by eating salted smoked ham. (Reported by Dr. M. Northup, Port Huron, Mich.)

3. Several cases of trichiniasis occurred near Flint, Mich., in the fall of the year 1875. Cases also occurred there in June, 1876. In the last outbreak, at least, trichinæ were found by microscopic examination in the meat, and also in a particle of muscle of the leg of one of the patients. (The cases were in the practice of Dr. A. B. Chapin, of Flint, Mich., now of Detroit.)

4. Five cases occurred in Otsego Township, Allegan County, Michigan, in February, 1877. All recovered. All were in one family, the members of which had eaten raw ham. Members of another family ate a small quantity of the meat, and were also sick, but recovered without medical attendance. Trichinæ were found in the meat by microscopic inspection.

5. Three cases, with one death, occurred in the city of Iona, Mich., in 1878, in the family of Mrs. Strunck. The meat was eaten raw. A microscopic examination of the meat was made, and, I believe, trichinæ were also identified in the human subject.

6. I am informed that cases, and one or more deaths, occurred in the vicinity of Iona, Mich., in the summer of 1880, in the practice of Dr. H. B. Barnes. Trichinæ were found in the pork, and also, I believe, in the muscles of those who died.

7. Five cases and two deaths occurred in the family of a German named Rumsock, in Lansing, Mich., in the last of January, 1881, and the first of February, 1881.

The cases were in the practice of Dr. Dolan, of Lansing, who has since died. Great numbers of non-capsuled trichinæ were seen by Dr. George E. Ranney, myself, and others in the muscles of a boy who died. (I still have slides showing the trichinæ as taken from the muscles of a person in the family who died.) Part of the meat was eaten raw. It was not examined for trichinæ; but the hog was sick and was killed to avoid loss of the animal.

8. Five cases of trichiniasis occurred in Vickeryville, Montcalm County, Michigan, in December, 1883. All resulted from eating the flesh of one hog. One death occurred. The boy who died had at different times eaten small pieces of pork only partially cooked by holding them on a fork before the fire. He had also eaten raw, on several occasions, little bits of sausage made from the flesh of the hog. Two others had eaten the meat cooked, but probably rare-done. The other person had eaten raw a little bit of sausage, perhaps half an ounce, but the rest of what he ate was well cooked. Trichinæ in abundance were found in the pork, specimens of which are now in this office. (Reported by Dr. J. Tennant, Carson City, Mich.)

9. Four cases occurred in January, 1884, in the city of Niles, Mich. One death has occurred and three persons are now seriously sick. The pork contains great numbers of trichinæ, as determined by observations made at Niles, Ann Arbor, and in this office.

Further details as to the five cases occurring at Port Huron, and also of the case at Detroit, are given in the published report of this board for the year 1875; and of those occurring in Otsego, in the report of this board for the year 1877.

Such answers as I am able to give to the four questions asked by your Commission have been summarized from the foregoing particulars, and are given with each question, as follows:

"Question 1. How many cases of trichiniasis have come to the knowledge of your board? Please give dates as far as practicable.

"Answer 1. I am able, at this time, to send you facts concerning *ten* outbreaks of trichiniasis occurring in Michigan. In three of these the number of cases was not stated. In seven outbreaks there was a total of twenty-eight cases. The dates are given in most instances in the report accompanying this.

"Question 2. In how many cases was there a microscopic identification of the trichinæ in the human subject and in the suspected meat?

"Answer 2. In two outbreaks the observer did not state whether any microscopic examination was made. It is believed that the human muscles were examined in five of the outbreaks, and in each of them trichinæ were found; in three of these it is positively known that trichinæ were found present. In seven outbreaks the pork was examined, and in each of the seven trichinæ were found in the pork. In the other outbreak, microscopic examination was made only of the muscles of the human subject, in which trichinæ were found.

"Question 3. How many of the cases were fatal?

"Answer 3. In one outbreak it was stated that there were no fatal cases; in one outbreak, where fatal cases occurred, the number was not stated; in one outbreak it was not stated whether any fatal cases occurred; in another outbreak, now in progress, one death has already occurred; and in six other outbreaks seven deaths were reported; making in all, in which the number was reported, eight deaths."

New Jersey.—The records of the State board of New Jersey extend from January 1, 1875, to date, a period of about nine years. During this period but one death from trichiniasis has been reported. This was in May, 1881, and was a female. The method by which the diagnosis was determined is not known.

New York.—The following report is furnished by the secretary of the board of health of New York City:

A few cases of alleged trichiniasis have come to the knowledge of the board, but there is no record of the number or dates.

In two families, during the past eighteen years, there has been, within the knowledge of this board, microscopic identification of trichinæ in the human subject.

During the past ten years five deaths attributed by attending physicians to trichiniasis have been reported to this board: one in 1875, one in 1878, one in 1880, and two in 1881.

The secretary of the board of health of Brooklyn, N. Y., says that five cases of trichiniasis have occurred in that city, of which a full history may be found in the proceedings of the Medical Society of Kings County for 1879.

North Carolina.—The secretary of the State board says that an equivocal case of trichiniasis occurred in Wilmington, in that State, but no microscopical examination was made. It was in the person of a boy of German parentage, habituated to using raw ham.

West Virginia.—The health officer of the city of Wheeling reports five cases—father, mother, and child of same, aged two and one-half years, and two females of other families. All ate of same meat—raw smoked ham—on March 4, 1870. No microscopic identification was made in the human subject.

Wisconsin.—The secretary of the Wisconsin State board of health says that some cases of trichiniasis have occurred in Milwaukee, but does not give the number or dates.

CAUSE AND PREVENTION OF TRICHINÆ IN SWINE.

The worm known as the *Trichina spiralis* has no stage of its existence outside of the animal body, and cannot multiply or even remain alive for any considerable time, so far as has ever been ascertained, after it quits its host. Every infected animal must become infected either by eating the muscular tissue of another animal which has previously obtained the parasite in the same way, or possibly by taking food which has been soiled by the excrement of an animal recently infected. It is generally admitted that eating flesh which contains the parasite is the most frequent, if not substantially the only, way in which trichinæ find their way into the body. A few cases have been advanced to show that pastures and feeding places may be infected and be dangerous for a considerable time; but, according to our present knowledge of the natural history of this parasite, it may be doubted if many instances of this kind occur.

When meat containing trichinæ is taken into the stomach the capsule or cyst which surrounds the worm is dissolved by the digestive liquids, the parasite is set free, develops into its mature form, the females are impregnated, and each gives birth to one thousand or more young. The young trichinæ penetrate the intestinal walls and find their way into the various muscles of the body, while the mature worms, and doubtless many of the young as well, are voided with the excrement. Now, it may be admitted that a large number of the mature parasites will be passed from the bowels before they have brought forth their young, and that if taken into the stomach of another animal the act of reproduction

would continue; but it seems doubtful if enough of such mature worms would be consumed in this manner to cause any serious infections. We do not know, however, how long the worms are able to live outside of the body in this developed condition; if they can exist but a few days the danger from them would be very slight, but if this period can be prolonged for weeks or months the danger would be more serious, and we might have at least a partial explanation of the many cases of infection occurring where the condition of life among the hogs seems to be all that could be desired.

The young trichinæ or larvæ which are produced in such enormous numbers in the intestines within a few days after infected meat has been eaten, and many of which are doubtless voided with the excrement, are practically incapable of dangerously infecting grounds or feeding places. These cannot reproduce themselves until they have found their way into the muscular system, and have been encysted for a time, so that even a considerable number of such larvæ taken into the stomach would produce no appreciable effects.

In the present condition of knowledge the tendency is to conclude that by far the larger part of trichinous hogs are infected by eating the flesh of some animal which has previously been infected in the same way. Trichinæ cannot develop or live for any considerable time in the bodies of insects, cold-blooded animals, or birds, and, consequently, the infection must result from some of the warm-blooded animals, which either habitually or occasionally eat flesh. Among these cats, rats, and mice are the ones most frequently suspected; but an inquiry into the conditions under which hogs are raised in the West has led us to doubt if the infection could occur in any considerable number of cases in this way. Hogs are usually kept in grass fields, where rats and mice are not common, and where cats certainly do not abound, and in no part of the hog-raising country is it a custom, so far as could be ascertained, to run the hogs in corn-fields, where there would be an opportunity of their finding rats and mice.

It has been charged that there was a custom of feeding the hogs which died from disease to the well animals, and that this accounted for the trichinous infection. After an extensive investigation, however, we feel authorized to state that this assertion is not correct. Such a practice seems to have been followed to some extent a half dozen or more years ago, but as the contagious character of hog cholera became better understood, and as the demand increased for the cheap grease rendered from such dead animals, they were more generally sold to rendering establishments at a price considerably beyond what they would be worth for animal food. The trichinæ of to-day must therefore be acquired from some other source than the hogs which die upon the farms.

The French and German authors have not hesitated to assume that our hogs were infected by feeding upon offal from the slaughter-houses, but this assumption could only have been made in complete ignorance

of the actual condition of affairs in the hog-growing sections of the country. Practically all of the hogs which go to the packing-houses are raised upon farms miles, and generally hundreds of miles, from any large city where offal could be obtained, and they are never fed upon anything but vegetable food. The blood and offal at the large packing-houses is dried at a high temperature and sold for fertilizers, and is never fed to the hogs even in the stock-yards. The foreign microscopists have the proof of this in their own hands, if they would only give the matter a little consideration before accepting the absurd statements of ignorant and prejudiced parties.

During the killing season as many as 60,000 hogs are received at the Chicago stock-yards in a single day, and it is evident that it would be impossible to furnish accommodations for holding this enormous number for any considerable time before killing. Now, the trichinæ which are found in American pork are in the vast majority of cases encysted, and for this condition to be reached time is required, and much more time than it is possible to hold hogs in the cities where alone offal for feeding them can be obtained. It is four weeks after infection before cysts are formed, and it is six weeks to two months before they reach the condition in which they are generally found by the microscopic examination of our meats. While we know from our own observation in all the cities where hogs are packed that the animals are not fed upon offal previous to killing, we have here in the condition of the trichinæ themselves the best and the most incontrovertible evidence that the animals were not infected by offal fed while they were held at the packing-houses before slaughter.

It is evident from what has just been said that we are unable at present to give a satisfactory explanation of the manner in which Western hogs become infected with trichinæ, for the conditions of life, at least so far as we are able to see, appear in the vast majority of cases to be all that can be desired. The infected hogs must be traced to the counties from which they come, and even to the farms on which they are raised, and the conditions studied as they exist on known infected premises, before it will be possible to give a solution to this difficult question. And until this is done no effectual rules for prevention can be formulated further than in a general way to recommend that the hogs have no access to any animal matter except what has been thoroughly cooked.

SALT USED IN PACKING.

The salts most generally used in packing in the United States are the Syracuse solar salt, of which 2,500,000 bushels were manufactured last year; Michigan solar salt, of which 50,000 bushels were manufactured last year, and Turk's Island salt. For rubbing hams either the ground solar salt or the Syracuse factory filled dairy salt is employed.

Some years ago the War Department of the United States Government caused some practical tests to be made by having meats packed with Turk's Island and Syracuse solar salt. The meats were afterward sent to the different forts on the sea-coast, on the Gulf of Mexico, and in the interior.

The result of the experiment demonstrated the fact that the Syracuse solar salt is equal in every respect for packing purposes to the imported Turk's Island sea salt, and since that time the United States Government has required that beef and pork packed for the Army and Navy shall be packed with Turk's Island or Syracuse solar salt.

American packers fully appreciate the importance of good salt, and are very careful in securing the best brands.

The following analyses of American and European salts show that the salts used in this country compare very favorably with those of Europe:

SALT USED IN THE UNITED STATES.

Description.	Sodium chloride.	Calcium chloride.	Magnesium chloride.	Sodium sulphate.	Calcium sulphate.	Magnesium sulphate.	Insoluble matter.	Water.
1. Turk's Island sea salt.....	96.760	.....	0.140	0.640	1.560	.....	.....	0.900
2. Syracuse, N. Y., solar salt.....	96.004	0.092	0.089	.....	1.315	.....	.....	2.50*
3. Saginaw, Mich., solar salt.....	95.831	0.356	0.140	.....	0.316	.....	.....	3.344
4. Lincoln, Nebr., solar salt.....	98.130	.....	0.080	0.390	0.250	.....	.....	1.200
5. Kansas, solar salt.....	93.060	.....	0.240	0.350	1.220	0.180	.....	4.950
6. Hocking Valley, Ohio, solar salt.....	97.512	0.234	0.089	.....	.....	.....	.....	2.130
7. Petit Anse, La., rock salt.....	98.882	0.004	0.003	.....	0.782	.....	.....	0.330
8. Syracuse, N. Y., "factory filled dairy".....	97.832	.....	0.037	0.026	1.263	0.023	0.120	0.700

ANALYSES OF EUROPEAN SALT.

	Sodium chloride.	Magnesium chloride.	Sodium sulphate.	Potassium sulphate.	Calcium sulphate.	Magnesium sulphate.	Insoluble matter.	Water.
9. Lisbon, Portugal, first crop sea salt.....	97.075	0.777	.....	.....	1.538	0.565	0.045	.....
10. Lisbon, Portugal, second crop sea salt.....	94.033	2.151	.....	.....	1.471	2.337	0.008	.....
11. Aveiro, Portugal, first crop sea salt.....	97.251	1.134	.....	.....	0.645	0.903	0.067	.....
12. Aveiro, Portugal, second crop sea salt.....	98.618	0.181	.....	.....	0.640	0.165	0.396	.....
13. St. Felices sea salt.....	94.072	0.141	.....	.....	0.373	0.060	0.116	5.073
14. Velicka, Galicia, rock salt.....	90.230	0.450	.....	1.35	0.720	0.610	5.880	0.800
15. Hall, Tyrol, rock salt.....	91.780	0.090	.....	1.35	1.190	1.210	2.490	1.890
16. Schönsbeck, Prussia, Saxony.....	95.400	0.080	.....	0.41	0.720	0.470	.....	2.900
17. Dürrenberg, Saxony.....	92.642	0.719	0.307	.....	1.632	.....	.....	4.700
18. Artern, Saxony.....	94.835	0.616	0.488	.....	1.061	.....	.....	3.000
19. Halle, Saxony.....	92.773	0.865	.....	.....	1.296	.....	0.466	4.600
20. Erfurth, Saxony.....	96.941	0.017	0.049	.....	2.093	.....	.....	0.906
21. Louisenthal.....	96.866	0.060	.....	.....	0.964	.....	0.110	2.000

AUTHORITIES FOR ANALYSES.

Analyses numbered 1 to 8, of salts used in the United States, were made by C. A. Goessmann, Ph. D., professor of chemistry in the Massachusetts Agricultural College, and published in a lecture on salt and its uses in agriculture, delivered before the State department of agriculture in Massachusetts.

Analyses 9, 10, 11, and 12, of Portuguese salt, is from the *Mechanics Magazine*.

No. 13 is by Von Kripp, and is from *Oesterr. Zeitschrift für Berg- u. Hüttenwesen*, 1867.

Nos 14 and 15 are by Von Stoba, and are from *Die chemische Mittheilungen*, Prag, 1880.

No. 16 is by Heine, and is taken from Knapp's *Lehrbuch der chemischen Technologie*, 3d ed.

Nos. 17, 18, 19, 20, and 21 are by L. Enders, and are from the *Archiv. der Pharmacie*, Vol. 143, p. 20.

EXTRACTS FROM LETTERS OF CORRESPONDENTS.

DISEASES OF CATTLE.

BLACK-LEG.—Mr. S. Woodsum, jr., of Wilkin County, Minnesota, writes as follows concerning black-leg in cattle:

I desire to give you my experience with the disease known as black-leg in cattle. Several years ago I lost quite a number of these animals, mostly calves, but I have had a number of cows attacked by the disease. It has invariably been those that were fat that were taken sick. The first indication of sickness is loss of appetite, staring coat and lameness, very sensitive to pressure on the outside of shoulders, and very laborious breathing. A *post-mortem* examination revealed the hind parts normal; the liver very black and tender and breaking into pieces at slight touch; the air passages through the lungs, the heart, and the heart case congested and filled with black blood.

The cause of this disease, I am convinced by experience and observation, is overfeeding. For instance, cows that were milked all winter, and were fed eight quarts per day of corn meal, linseed meal, oat meal, and wheat bran, went through the winter without getting sick; but cows that came to the barn fat and dry, and were not fed anything but hay until after dropping their calf, when they were put on the same feed as those that had been milked all winter, were taken sick in every instance. Again, cows that came to the barn dry and fat, and received a daily ration of feed of the same quality as the other cows, but a much less quantity than before dropping, and then increased in quantity to the same amount as the others, got through without being sick.

My experience has been about the same with calves as it has been with cows. A calf that had been allowed to run with its dam all summer, being very fat, was turned into a field where grain had been harvested and a very luxuriant growth of volunteer grain had sprung up, and it was soon taken sick.

As a preventive we quite often read that salting twice a week will prove beneficial, but this never made any difference with the stock in this vicinity, from the fact that I was about the only one that kept salt where the animals could get it night and morning, and yet I lost as many, if not more, than any of my neighbors. I have always fed more grain than any one else in this neighborhood.

When Dr. Hurn, of the Signal Service, was here, some seven or eight years ago, I described the *post-mortem* appearance of an animal that had died of black-leg. He advised me to try drenching with strong salt brine, and I am happy to say that I accepted his advice, and have not since lost either a cow or a calf. Put one-half pint of salt into a quart bottle, fill with water, shake well, and give about half as the first dose; in about an hour give the remainder, and one hour later repeat. The following day the operation should be again repeated. I have used this remedy in the case of sick horses with satisfactory results.

Mr. L. E. Rowe, of Anderson County, Kansas, recently lost eight head of yearling steers by black-leg. Writing, under date of August 8, he says:

I have lost eight head of yearling steers out of a herd of one hundred and thirty-five brought from Shaanon County, Missouri, to this county this season. The disease is

called black-leg, and I can learn of no remedy from local sources. A steer, apparently well yesterday, at evening was observed staggering about, at daylight this morning it was down, at 7 a. m. it was unable to rise, and at 8 a. m. it was dead. On cutting the animal open various dark, bloody spots were found under the skin and involving the tissue. The heart was seriously affected.

An epidemic of black-leg prevailed among cattle in Trego County, Kansas, during the months of November and December last. In the early part of December Mr. Ben. C. Rich, of the above-named county, informed the Department that over one hundred head of cattle had died of the disease in Ogallah Township alone. He had lost eleven animals himself, a neighbor had lost seven, another seven, and still others three or four each. As to the *post-mortem* appearances of the disease, he says:

I was to-day called upon by a neighbor to make an examination of three animals which had just died, of which I send you the following imperfect report:

No. 1. A heifer calf four months old, still fed twice a day on milk and the run or wheat and rye. The first symptoms were weakness in hind limbs and small of back, and a dragging motion of hind legs when attempting to walk. When opened, the blood was found discolored on inside of both hind legs and over the left kidney. The tissue which surrounds the paunch and intestines was also discolored. The small intestines and manifold were very tender and easily torn. There was no bake. The melt was much inflamed and bloody and very tender. Other organs seemed normal. Yellowish froth issued from the mouth.

No. 2. A cow three years old and giving milk. Appeared well yesterday morning when milked. Sickness discovered in afternoon, and died during last night. The first symptom was lameness in right hind leg, which was much inflamed at stifle joint and very sore to the touch. On opening, found the whole right horn very much inflamed; flesh very dark and bloody, and over right kidney the same; tissues surrounding the paunch and small intestines much discolored; manifold baked; liver inflamed, and so tender that I could tear it easily with my finger. About a quart of bloody water was found in the cavity of the body. There was no discoloration on front part of body. All other organs seemed normal. The animal was five months gone with calf.

No. 3. A fine, large-grade cow, three years old next spring, and six months gone with calf. This cow did not seem stiff in joints or weak behind previous to death. She ate heartily up to 4 o'clock p. m. yesterday, at which time she was first noticed to be sick. She died during the night. The lesions were confined to the breast and between the front legs. These parts were very much inflamed and the flesh dark and bloody. No discoloration was found on hind parts, back, paunch, or intestines. No bloody water in cavity. The liver seemed all right, but the manifold was baked. The heart was clotted, and the lungs discolored and congested.

Mr. A. E. Hall, of Fort Meade, Dak., writes as follows concerning the ravages of black-leg in that locality:

A disease is prevailing among cattle in this county called black-leg. I examined two animals about twelve hours after death. Upon opening the body the blood seemed almost all gone. What little was left seemed to have settled between the layers of flesh and tissues. The flesh was a little higher colored than beef. The first animal had a swollen shoulder, and when rubbed with the hand emitted a crackling sound. It was full of air-bubbles immediately under the skin. The last stomach was very dry, almost baked. The small intestines leading to the last stomach were green or the distance of three or four inches. The animals show different symptoms. Some became swollen all over, some in one leg, and some not at all. We have lost about a dozen range calves. But yearlings are not exempt from the disease, and sometimes cows are attacked. It does not make any difference as to whether the animals are

fat or thin, native or thoroughbred stock. Texas animals seem to be exempt. The disease is very rapid in its work. An animal that is apparently healthy and very lively in the evening may be found dead the next morning. Occasionally one may be stupid for three or four days, but as a rule they die in a few hours.

There is also a disease here among cattle which affects their feet. The foot swells between the toes, laming the animal. In the worst cases the leg swells as high as six inches above the ankle, ulcerates, and exudes a white matter. Sometimes the flesh protrudes from these ulcerated places. It generally disappears of its own accord, but the worst cases either lame for life or kill the animal.

Cattle in Saline, Mitchell, Phillips, Lincoln, Ottawa, and other counties in Kansas suffered severely with this disease during the past season. Mr. Charles E. Faulkner, of Salina, Kans., writing in December last to Hon. J. J. Ingalls, speaks of the disease as being wide spread and disastrous in the counties above named. The following extract is made from Mr. Faulkner's letter, which was kindly forwarded to this Department by Senator Ingalls:

Many thanks for your notice of my communication regarding black-leg among cattle in Kansas. The Department seems to have made no special investigation of this disease. Losses this season will be heavy in the State. Over one hundred head have died in this county (Saline) during the last three months, and the end is not yet. Losses from Mitchell, Phillips, Lincoln, and Ottawa are reported. I hope that Congress will aid the Department in instituting a thorough investigation of the subject, in order that we may become better informed of the nature of the disease, its cause, and preventive measures.

CONTAGIOUS PLEURO-PNEUMONIA IN NEW JERSEY.—Dr. William B. E. Miller, of Camden, N. J., writing to the Department under date of November 10 last, says:

On the 31st ultimo I was summoned to visit a herd of cattle at White House, Readington Township, Hunterdon County, in this State. On the 1st instant I examined some cattle on the farm of Mr. George Clum. Among his herd of about 60 cows I found several infected with pleuro-pneumonia. During the past four months he has lost 22 head. Soon after the first outbreak in the herd he had all the animals inoculated. On another farm owned by Mr. T. W. Pidcock, and tenanted by Mr. Charles Snyder, near Three Bridges, Hunterdon County, is a herd of 65 cows. About the first of March last there was brought from Bradford County, Pennsylvania, to Farmington, N. J., a car-load of cows. From this car-load Messrs. Pidcock and Snyder purchased 13 head. Ten of these animals were put on their farm and three were sent to another farm. The animals then upon the farm were nearly all inoculated. Pleuro-pneumonia broke out among these ten new arrivals, and soon eight had died. One was killed for the purpose of securing virus for inoculation purposes. All the remaining animals were then inoculated a second time. There have been several cases on the farm since, but I was unable to get the exact number at the time of my visitation. Every lot of fresh cattle brought on the place since have immediately been inoculated, but out of every lot one or two animals would either die of the disease or be killed. On another place occupied by Mr. Peter Pidcock, where there had never been a case of contagious pleuro-pneumonia, a bull was brought from the F. N. Pidcock farm that had had the disease but was supposed to have recovered. He infected this herd of 46 cows, and 8 animals died before the contagion abated. All the animals were inoculated as soon as the disease broke out among them. On another farm, occupied by Mr. W. D. Ammerman, 8 or 10 animals died of the disease during the summer months. There are 41 head in one lot and 29 in another on this farm. All have been inoculated. There is one acute case now on this farm. The animal has been inoculated, but still

she is suffering from acute pleuro-pneumonia. On still another farm, owned by Mr. Garret C. Gearhart, six animals have been attacked and four have died. All the other animals have been inoculated.

You will observe that every fresh cow brought on to these places, if not soon inoculated, suffered with pleuro-pneumonia, and that while inoculation prevented the animals on the farms from death, the disease has been reproduced in every fresh lot in the genuine form, killing most of those attacked.

CAUSE OF ABORTION IN COWS.—Mr. Robert T. Burbank, proprietor of White Mountain Stock Farm, Shelburne, N. H., writes as follows, under date of March 24 last :

In 1879 fourteen of my herd of thirty-five thoroughbred cows aborted. During the next year I kept strict watch over them, guarding them from storms in summer and keeping them dry and warm in winter, in order that I might discover the cause of the trouble. Notwithstanding my care and watchfulness, five of the animals aborted the following year. I then frequently, with the greatest care, examined my hay fields. In two of these fields had sprung up, from seed I had purchased for high-grade Western timothy, a rank growth of wild rye, and also weeds about two feet high, resembling what is sometimes called "wild strawberry." The seeds of these weeds appeared much like the seeds of timothy. I gathered some of the weeds and sent them to the seed merchant of whom I purchased my hay seed, stating that I was satisfied that I had discovered in this wild rye and its seeds the cause of abortion in my cows, and requesting him to have the seeds examined and report the result to me. He treated the matter with such indifference that I have since ceased to purchase of him.

The hay cut where the wild rye and those weeds grew in the following year (1881) I put in my young-cattle barn, and did not allow my cows to eat any of it. I have since raised nearly all my own hay seed, and last year only one of my cows aborted. This year all have escaped. I already have seventeen beautiful, healthy calves. Their dams are also perfectly healthy and in good condition. Several years since I expressed the opinion that there must be something in the hay similar to ergot that caused this mischief. I have from time to time reported these facts to breeders who have called upon or written me in relation to abortion in their herds, and several have used care in regard to hay seeds with good results.

I notice that the veterinarians employed by the Government to investigate the outbreak of alleged foot-and-mouth disease in the West state that the malady is not the contagious disease it was supposed to be, but was caused by ergot in the hay. Now, if ergot in the hay will "contract the blood-vessels and retard circulation," as reported by these surgeons, have we not discovered the cause of abortion in cows that eat such hay? In my case I feel quite sure that I have discovered a cure, viz., feed with hay free from ergot. I do not think hay seed from the West should be sold here until after it is thoroughly inspected.

TUBERCULOSIS.—Dr. J. A. Rice, of Liberty Mills, Orange County, Virginia, in January last reported the following cases to the Department :

Last summer a young steer in our herd that had been improving so rapidly as to be the subject of remark was one day found apparently suffering with rheumatism. He continued to decline until sold. I afterwards learned that on being slaughtered his lungs were found very much diseased. In October two of our dairy cows (one of them very fat) were taken with symptoms very similar to those of the steer—separating themselves from the herd, stiff in the shoulders and neck, loss of appetite, costiveness, rapid shrinking in their milk, no cough, and no symptoms by which we could diagnose the disease. The decline has continued without any special symptoms except those mentioned, aside from a great shrinkage in flesh.

Yesterday we slaughtered one of the cows to see if we could not find the cause of the disease. We found the heart and lungs very large and filled with tubercles. The omentum felt like a hard, round cord, and was filled with tubercles, in fact seemed to be one tuberculous mass. We found the liver, spleen, stomach, and intestines all healthy. In cutting into the tubercles they presented more of a sarcomatous appearance than of true tuberculosis. Thinking the specimens might be of interest to your veterinarian, I have boxed up the lungs and omentum and forwarded to your Department, and would be glad to hear the result of the examination. These cattle were all bred upon the farm. I have bred their ancestors on dam side for more than thirty years. They were superior dairy cattle, of fine constitutions and remarkably healthy. I never knew one of them to be sick before. They were of different strains—the sire of the cows was a Mazurka bull by Royal Oxford, of the steer a Miss Kirby cow by the Rhenish bull Joe Johnston. If this is true tuberculosis, how did it originate?

A day or two later (February 1) Dr. Rice writes as follows concerning the second cow:

We killed the other cow to-day, and found such a growth of fungoid matter that I hasten to send specimens, believing they will aid your veterinarian to form a more correct diagnosis of the cases. From all I can learn about the steer, he presented similar growths. They are remarkable, and owing to the previous healthfulness of the animals, and that of their ancestors on all sides, I am able to form no opinion in the premises. You will find myriads of small fungi growing from the larger ones—some much resembling mushroom growths. The lung presented very much the condition of the one we forwarded yesterday. We to-day send liver entire, its preternatural adhesions to midriff and pectoral coat of stomach by fungous growth; a section of rib and brisket, showing growth of fungi to the inside membrane of the ribs; sections of lung, peritoneal covering of bowels, omentum, &c.; also a piece of stomach with growth growing from its outside coat. All of the interior of the ribs were covered with growths such as specimens represent, and many with dark bodies hanging attached by long, narrow necks to the membrane between the ribs, resembling hydatids, but the bodies were hard and fleshy.

There has never been any cough with either animal, only a gradual decline with the symptoms given in my first letter, except that the one we killed to-day was taken a day or two ago with a profuse, watery diarrhea, which was weakening her down rapidly.

The specimens arrived in good condition, and, after examination by the veterinarian, Dr. Rice was informed that the disease with which his cattle were suffering was undoubtedly tuberculosis. He was counseled to destroy all remaining animals showing signs of the malady, and advised to thoroughly disinfect his stables, which should not be again occupied for a year.

IMPACTION OF THE MANIFOLD.—Mr. P. H. Powers, of Wickliffe, Clarke County, Virginia, statistical correspondent, recently lost some cattle by a disease unknown in that locality. Under date of February 18 last, he wrote the Department as follows:

I have lost, within the past ten days, two three-year-old steers, affected similarly and so acutely that I deem it proper to report the cases to the Department. When first observed, which was about 6 o'clock a. m., each of these steers seemed suffering with violent itching about the head, particularly along the jaw and around the eyes. So violent was this that they would run to the fence or posts of the barn and rub until the whole side of the head was made raw and bloody. Accompanying this itching was a spasmodic twitching or jerking of the head sideways and upward, occurring constantly, and at intervals of about a minute. There was some foam about the

mouth. So acute was the disease that each animal was dead in less than ten hours. No other symptoms were observed. These steers were in good condition. One was raised on the farm, and the other bought in Chicago in November last.

Later, on February 25, Mr. Powers again wrote the Department giving additional information in regard to the progress of this disease. He says:

I have since lost another very fine animal with symptoms identical with the others. Death ensued within twenty-four hours. These cattle were all in fine condition, have been well cared for and had access to water, and were fed on corn-fodder and wheat-straw. In fact, the management has been the same that I have given my stock cattle in the winter months for thirty years. The difficulty seems to be that no evidence of disease or ailment appears which is noticeable until the animal is in *extremis mortis*, when all remedies would seem unavailing. A farmer living some ten miles from me in this county has lost, I understand, some seventeen head this winter. As soon as I can ascertain the facts I will report them.

On receipt of Mr. Powers' first letter, he was informed by the veterinarian of the Department that his cattle were suffering with impaction or obstruction of the manfolds from eating too much dry food, and advised to give full doses of purgatives combined with stimulants.

The following deaths described by Mr. J. B. Warren, statistical correspondent of Rooks County, Kansas, no doubt occurred from acute indigestion or impaction:

One of my neighbors has lost six head of cattle within the past ten days. They died within from one to three hours after the first symptoms were observed. I opened four of them, but found nothing wrong with any of the organs except the stomach and bowels. The inside coatings of these seemed as though badly eaten with lye or some other strong substance. There was very little blood, and around the stomach it was settled in black clots. A foamy froth, resembling thick, slimy soap-suds, passed from the animal's mouth while suffering from the disease. Before death they bloat badly. All the animals attacked were in apparent good health and excellent condition up to the time the first symptoms were observed.

CATTLE POISONED BY VEGETATION.—Mr. George W. Carleton, Gayoso, Pemiscot County, Missouri, writes under recent date as follows:

Since the February overflow of the Mississippi River, a great many cattle have died, especially cows. They are affected with weakness in the loins, break down, drag their hind legs, fall down and cannot rise, thrash their heads upon the ground, and die within two hours after being attacked. I assisted in the dissection of a two-year-old heifer that died within an hour after showing symptoms of the malady. Upon opening the stomach we found a quantity of an undigested root of a vine that grows in great abundance here, known in the country as "cow itch," trumpet-flower, or cow-vine—*Bignonia radicans*. Near the bank of the Mississippi River, where the current in the "back-water" runs very strong, the soil has been washed off and the roots of this vine left exposed, and, being very tender, cattle eat them ravenously. All the inner coating of the stomach was of a very dark purple color; on the spleen were found a few parasitic worms; about two inches square of the spleen was inflamed and appeared to have been perforated. In all probability these parasites had caused the damage. Upon removing the skull we found a great pressure of blood, serum, and water on the brain. This was no doubt caused by the action of the poisonous roots found in the stomach, and was the immediate cause of the animals' death. Within the last ten days several farmers have lost valuable cows, and all of them have eaten of the root of the *Bignonia radicans*."

Mr. J. G. Knapp, Limona, Fla., who is the statistical agent of the Department for that State, forwards the following extract from a letter addressed to him by Mr. F. A. Hendry, of Fort Myers (Caloosahatchee), Florida, in April last:

Some cattle have dropped dead in this locality, number not known. For several years cattle have died here from this unknown cause. So far the cause is a mystery. A few years ago one thousand or more animals died in fat condition. All ages and sexes were alike affected. There is no lingering; apparently as sound as can be and in a minute of time lifeless. It is not contagious—prevails only in certain localities. I have dissected the animals and examined carefully, but found no internal evidence of disorganization.

Mr. Knapp adds that the indications are that some very active vegetable poison is the cause. Several very poisonous plants and trees, such as the *Hippomane* and other *Euphorbiaceae*, with the *Rhus metopium*, grow there.

HORSES.

HORSES POISONED BY VEGETATION.—A correspondent at San Antonio, Tex., informs the Department that there have been heavy losses of horses through a strip of country where the live oak, red and post oak, and the hickory grow. This district runs through Medina, Atascosa, Bexar, McMullen, Live Oak, Wilson, and Frio counties, and ends about the boundary line of De Witt. The land in this district is generally of a sandy nature, and does not produce a vigorous growth of any variety of grass, though it is for the greater part of the year, on an average, a fair range country. At this time of year (April) there is little grass in this district, and stock have been subsisting partially, for some time, on acorns, to the eating of which the losses of horses are attributed. Mr. Duck, Mrs. O'Brien, and others, have lost quite a number of animals, and it is reported there have been some losses in W. W. Robbins' pasture, where stock has been placed for fattening. The horses, when first attacked, seem to be drawn together as if in loin distemper, and appear to suffer greatly, virtually walking on the tips of their hind hoofs. Then they gradually pitch forward, fall to the ground, and never get up again. The affliction does not seem to have any relation to the condition of the animal, as some of the fattest horses in the country have fallen a prey to the malady. Mares seem to suffer most. Mr. Duck attributes the losses to acorns, which are not only wormy, but were not so well matured as in former years. Hogs, however, have grown very fat on them.

TERRIBLE DESTRUCTION OF FARM ANIMALS BY BUFFALO GNATS.—The losses of farm animals last spring in some of the Southern States from the irritation and poison of buffalo gnats were very heavy. No deadly contagious disease has ever caused such destruction among the herds and flocks of the Southwest as have these poisonous pests during the past season. Mr. A. F. Osborn, Winnsborough, Franklin Parish, Louisiana, writing to the Department under date of May 15 last, says:

Fully one-half of all the farm animals of this parish have fallen victims to the poison impregnated by the bite of the buffalo gnats. Horses, mules, cattle, sheep, and hogs

have alike succumbed to the scourge, and there seems to be no abatement except in localities where the material to act upon has disappeared or been exhausted. Some persons have lost all, others two-thirds, and he is indeed fortunate who has saved half his stock. The dead carcasses lie bloating around fields and on highways, and nothing—not even a buzzard—will touch them. The stench arising from these putrid carcasses is almost intolerable, and fears are entertained that a pestilence will follow.

On the 22d of April we collected partial statistics from two of the nine wards into which the parish is divided. As far as we were able to ascertain the deaths in those two wards amounted, at that date, to 3,187. Many individuals, in handling and skinning the animals, have been poisoned. Some have already died, others will probably die, while still others will escape with the loss of a hand or an arm.

Mr. Thomas B. Gilbert writes from Oakley, La., under date of June 29 last, as follows:

About the middle of April last a fatal disease broke out among cattle, horses, mules, hogs, and sheep in this parish (Franklin) and the adjoining parish of Richland. It attacked all of the above-named animals almost simultaneously, making its appearance first among the cattle a few days after the dreaded buffalo gnats came in. The time for the buffalo gnats to make their appearance here varies with the heat or cold of winter. They came earlier in 1882 than I ever knew them to come before—say, about the 5th of March; but the usual time is from the 1st to the 10th of April. This year they came about the 1st of April, and in a few days multiplied into millions, spreading over the entire country, and no animal could survive their attacks many hours unless protected by smoke. They have a great aversion to smoke, and this is the only protection our animals have from their ravages. Work animals are greased as an additional protection. The gnats were more numerous this year than common, but not more so than they were in 1882. In this parish (a small one) about 3,000 head of horned cattle died in a few days, and about 300 head of horses and mules, 5,000 or 6,000 head of hogs, and as many sheep. The horses and mules are still dying at intervals. In these the disease assumed the form of charbon; it did the same with many cattle; and what is singular, the only cattle, horses, and mules that recovered were those that it attacked in that form. All those attacked in the other form of the disease (*i. e.*, without external swelling) died. Now, what could have occasioned this dreadful and fatal plague among our domestic animals? The disease appeared in a belt of country, say 25 miles in extent from north to south, and extended at least that distance east and west. North of that line there was no disease, and south of it there was none. How far west on that parallel the disease extended I do not know. But on the east the Bayou Macon was the line of demarcation.

It is safe to say that the people of Franklin and Richland parishes have lost more than \$150,000 worth of cattle, horses, mules, sheep, and hogs from this fatal disease. I think that next year a competent man from your Department ought to be sent into every county of Arkansas and Mississippi, and into every parish in Louisiana infested with buffalo gnats to study their habits, origin, and the cause of the disastrous effect they are yearly having upon the inhabitants and the domestic animals of the infested district. This pest is assuming such alarming proportions as to threaten the depopulation and abandonment of all the high-land country adjacent to or bordering upon the overflowed regions of the Mississippi Valley. It is not confined to the valley proper, but the highlands contiguous to, and for many miles inland, are worse cursed with the buffalo gnats than the lowlands themselves. I was born and raised here, am 46 years old, and never saw or heard of the pests until 1865. They have come with the annual overflows every year since, and their ravages are so far extended over this region of country, and so fatal to man and beast, that the continued occupation of the country is problematical. Some deaths and many cases of charbon have occurred among our people, both black and white.

VARIOUS REMEDIES AND PREVENTIVES.—Mr. Byron L. Saunders, Purdy, Tenn., writes as follows, under date of April 5, last:

The new disease which has recently made its appearance among cattle in Illinois and Iowa prevailed among my cattle last winter a year ago. If taken in time it is very easy to manage. Strong apple vinegar, or acetic acid, and blood-root—a strong decoction or tincture, applied three times a day will cure it.

For swine plague and fowl cholera: Equal parts of soda, alum, and copperas, and one-tenth part of blue vitriol. To prevent the plague, feed mandrake to the animals in their slop.

For murrain in cattle, Spanish fever, and inflammation of the liver: One-half cup of lobelia seed, $1\frac{1}{2}$ cup of blood-root, $\frac{1}{2}$ cup mandrake, 1 cup wild-cherry bark, 2 cups dog-fennel blossoms, a piece of garget, or poke-root, the size of a small hen's egg, to which add one gallon of water and boil down to one pint and a half of solution. This is a dose for a grown animal, and if given in time will generally effect a cure in the above-named diseases.

Mr. L. A. Cook, Milledgeville, Ga., states that twenty-five drops of tincture of aconite given when symptoms are first observed is almost an infallible remedy in any form of colic. He has never known it to fail, and says that a second dose is rarely necessary. He regards it as the simplest and surest of all remedies.

HOGS.

BREEDS AND SANITARY CONDITION.—Mr. Henry C. Mosely, Lawrence, Kans., regards our present breed of hogs and their sanitary condition all that could be desired. He writes to the Department as follows:

I have traveled for fifteen years in the great hog-producing regions of the Mississippi Valley, and have therefore no hesitancy in declaring that the sanitary condition of swine is now better than at any period in the past twenty years. And why? Because the swine producers are provided with acclimatized and better breeding animals, and are not now introducing new stock, which the farmers all admit has been one of the most prolific causes of disease. The most extensive swine producers now allow their animals to range in pastures during the summer months; feed them less corn; provide more and better water; are watching them more closely, and gradually reducing the rearing of this class of animals to a science. The American hog is now, in my humble opinion, all right, and the way to continue its prosperity is for the non-swine producers to adopt the non-intervention policy, or hands off, and leave it where it now is, at the front.

EFFECTS OF FEEDING SWEET POTATOES.—Mr. J. G. Knapp, statistical correspondent for the State of Florida, writes as follows under date of April 10 last:

Allow me to call your attention to a remark made by J. M. Strickland, my correspondent from Putnam County, which is new to me. He says:

"It is thought that feeding potatoes (to hogs) during winter is the cause of cholera. Last year I lost all the hogs that I put on my potato ground, and this winter they came off in poor condition, with a loss of 25 per cent."

Potatoes here mean the sweet potato, *Batata edulis*. The hogs are placed in the grounds to root for those that are left after the crop is dug. These potatoes remain

sound in the ground during the winter, as there is not frost sufficient in many portions of the State to destroy them if disconnected with the vines. Can there be anything in these potatoes to produce cholera?

Cholera or swine plague is a purely contagious disease, and can only be communicated to the animal by coming in contact with the virus. Possibly sweet potatoes might render hogs more susceptible to the disease than some other kind of diet.

SWINE PLAGUE IN ARKANSAS.—Mr. Felix G. Davis, of Grand Lake, Chicot County, Ark., writes as follows under date of March 5:

Through the kindness of Senator Garland and Hon. P. Dunn, of this State, I have received three copies of the Report of the Department of Agriculture for 1883, two of which I distributed to my neighbors. I think a copy ought to be in the hands of every intelligent farmer. The reports on swine plague, chicken cholera, and charbon are of great interest to us, especially the report on swine plague, or cholera, as it is vulgarly termed. On this Isle of the Swamps, or Mason Hills, as it is called, we are now being visited by this bog disease to an alarming extent. Five stock hogs that in January were fat and healthy are now dying on every farm, and those left are generally poor in flesh. Being deprived of their usual range by an overflow of the swamps has no doubt had much to do with the spread of the disease.

SHEEP.

NEW DISEASE AMONG LAMB.—Some months ago Mr. G. W. Marshall, Eckley, Carroll County, Ohio, wrote as follows concerning a disease which at that time was destroying a great many spring lambs in that locality:

We have a strange disease among our spring lambs here this spring that I think should be investigated by the Department. They die when they are from three to five weeks old. Apparently the very best lambs in the flocks will be well, as far as you can see, in the morning, and by night will be dead. They act as though they had spasms or fits. We have lost six, and some farmers have lost as high as thirty or forty this year. It is not in all flocks, just here and there. Sometimes you will find five or six lying dead at a time. I hear of it in places all over the county. We cannot tell what the disease is, nor have heard of any remedy for it. Some claim they get too much milk; others say that is not the trouble. Some call it lamb cholera.

In answer to a letter of inquiry asking for further information as to the symptoms of the disease and the *post mortem* appearances of the animals that had died of it, Mr. Marshall writes:

No more lambs have died since receiving your note, hence I have had no chance to make a *post mortem* examination. However, a neighbor says he examined several, and there appeared to be water about the heart, an unusual amount; the gall appeared dark and slender, as though rolled up; stomach and other parts all right, as far as he knew. The lamb when first observed seems entirely helpless. It then has spells as though affected with a fit; plunges about, works its ears and mouth, rolls its eyes and froths at the mouth. The animals generally attacked are from three to six weeks old, and are usually those in the best condition. They live from six to twelve hours after the first symptoms of the disease are observed. We took our ewes off good blue-grass, white clover, and timothy pasture and put them in a woods pasture, after which we lost no more lambs. My observation has been that the lambs that have died have been those that have had the greatest amount of milk from their mothers.

A FATAL LOCAL DISEASE.—A fatal disease, which is no doubt local in its character, is described as follows by Mr. L. F. Dupron, living near Savannah, Ga.:

A disease is prevailing here among sheep which seems to be peculiar to animals feeding on the seaboard. The principal symptom is a swelling on the under jaw. The swelling contains a hot, watery fluid; if opened and the fluid discharged it will soon fill again with increased heat over the affected part. Diarrhea sets in, which is soon followed by death. Sheep over three years old frequently die before diarrhea occurs. The disease is most fatal to lambs, though I have known but two recoveries out of hundreds of animals attacked. Sheep grazed in woods pastures seem as liable to the disease as those grazed in the salt marshes.

GENERAL CONDITION OF FARM ANIMALS, 1883.

ALABAMA.

Barbour.—I have not heard of the prevalence of any diseases among hogs and sheep during the year, and there has been no epidemic among either horses, mules, or cattle. I estimate the value of all animals lost by disease at \$8,170—except fowls—being my estimate of increase on the census of 1880. Our State has established a department of agriculture, and will hereafter require statistics gathered by the county assessors.

Bibb.—Some cholera has occurred among hogs and fowls, and not among sheep, but the aggregate losses cannot be given. No stock-breeding here of any consequence. Nothing would pay better than the breeding of large draft horses, and heavy improved cattle for beef. The range for stock is good for nine months in the year.

Blount.—I estimate the value of losses among farm animals and fowls in this county during the year, by disease, as follows: Horses, \$3,500; cattle, \$5,400; hogs, \$3,000; sheep, \$375; fowls, \$500; being a total of \$12,675. This statement is derived from knowledge obtained from many citizens of the county. Horses and mules have been afflicted with no special complaint. Hogs have died from cholera, neglect, and lice. A few sheep have died from rot, but a great many have been killed by dogs. The loss caused by these animals is not included in the above.

Bullock.—Hogs and fowls are almost always affected by so-called cholera. The only disease incident to cattle is hollow-horn. Mules frequently die of colic, and horses of bots and gravel. Not one horse in a hundred dies of epizooty when it comes around, but at least 10 per cent. of the mules succumb to it. It has always been brought here by traveling showmen. We have no fatal disease among sheep. I have lived at this place since 1872, and have never lost a fowl of any kind by cholera or any other disease, and we have some hens that are known to be fifteen years old. My wife has lived here over thirty years, and says there has never been any disease among poultry since she can remember. We have no fowl-house; our chickens roost in trees, and we never allow them to roost in the same tree more than three months at a time. Year before last a niece of my wife lost all her chickens, and asked my wife to give her a start again. We did so, and furnished her with five hens and a rooster. Those fowls were carried a distance of 9 miles, and in less than a week's time they all died.

Choctaw.—There have been some losses among farm animals, occasioned by disease, but it is impossible for me to give anything like accurate data. There have been, to my knowledge, several cases of glanders among horses and mules. Those cases that came under my observation were not treated by veterinarians, but were neglected and the animals allowed to die.

Clarke.—From my own personal knowledge and the best information I have been able to obtain, I am able to state that no epidemic of any kind has visited the farm animals of this county during the present year.

Chilton.—It is very seldom that disease of any kind ever prevails to any extent among farm animals in this county. Horses and cattle usually die of old age. About fifty sheep were killed by dogs during the past year.

Coffee.—Quite a destructive disease prevailed among chickens last spring. Seventy-five per cent. of the young chicks died of it. The disease was thought to be caused by mites. There has been no marked disease of any kind among stock. Several valuable horses and mules have died, some from staggers and some from colic. Hogs have done well and are still doing well where they have been properly fed. Our peo-

de are turning their attention to the finer breeds of hogs. Hog cholera has not prevailed to any considerable extent this year, though at least 50 per cent. of the hogs of the county died of it last year. It has been prevalent in several neighborhoods in adjoining counties the past season. Stock comes to fine perfection in this county, and sheep-raising is very easy and of great profit. The largest mule in the State was bred and is still owned by Col. Thomas Patents, of this county.

Coosa.—No disease of a destructive character has prevailed during the year among either horses, cattle, or sheep. Cholera has destroyed 33½ per cent. of the hogs of the county. I cannot give the number of domestic animals in the county.

Crenshaw.—There has been no disease of any kind among our farm animals for the past two years.

Cullman.—Hogs are more subject to disease in this county than any other class or farm animals. However, but slight losses have occurred from disease among any class of stock during the past year.

Dallas.—The value of horses lost by disease during the year I think will amount to about \$5,000. I estimate the number of hogs in the county at 25,000. Fifteen hundred of these have been affected by disease. Of the number thus attacked I think 20 per cent. have died. The losses among other classes have been very light.

Fayette.—The only diseases that have prevailed to any considerable extent among farm animals in this county the past year have been rot and scab among sheep. A great many fowls have died of a fatal disease called cholera.

Franklin.—With the exception of a few cases of epizooty the health of horses has been good. No fatal cases have occurred. Sheep are also in good health. Cholera has prevailed among hogs and fowls, and about all those attacked have died. I cannot give the number of farm animals in the county.

Geneva.—Sheep valued at something like \$700 have been lost the past year from various causes. No widespread disease of any kind has prevailed among our stock during the year.

Hall.—The diseases that have prevailed among our farm stock this year are common, and such as are oftentimes occasioned by neglect and ill treatment. Sheep die of a lingering disease called rot by some, which is regarded as incurable. Hogs die of cholera, a disease which is also regarded as incurable.

Henry.—No widespread disease of any kind has prevailed either among our farm animals or fowls during the current year. Some few horses have died, but I believe the loss was occasioned more from bad treatment than disease. A great many hogs have been raised in the county within the last twelve months.

Lauderdale.—I can give you no definite idea as to the number of farm animals in the county. A few cases of cholera among hogs have been reported.

Lawrence.—Hog cholera has been very destructive in this section this year, having destroyed five-sixths of this class of stock. Chicken cholera has also prevailed. Blind-staggers has been very fatal to horses and mules. I think the value of our losses for each class has been about as follows: Horses and mules, \$2,360; cattle, \$1,000; hogs, \$37,500; sheep, \$150; chickens, \$1,500.

Limestone.—I cannot procure the data you desire. There has been no unusual sickness among farm animals the past year. Last year many farmers fed shelled corn to their stock without hay, and the result was the loss of a good many animals.

Macon.—There has been no destructive disease among horses or other classes of domestic animals for the past year or so. What is known as cholera has been very destructive to fowls. It is a very common disease, especially among chickens.

Mobile.—No disease of a malignant character has prevailed among any class of farm animals the past year. A few cases of catarrhal fever have occurred among horses and mules brought from the west and Tennessee and Kentucky, but they were attended with no fatality.

Monroe.—The value of farm animals and fowls lost in this county by disease the present year is between \$6,000 and \$7,000, distributed among the different classes as follows: Horses, \$3,750; cattle, \$2,000; hogs, \$100; sheep, \$300; fowls, \$50.

Pike.—Domestic animals in this county have been remarkably healthy this year. No disease of an epidemic character has prevailed among either horses, mules, cattle, or sheep. Cholera among hogs has prevailed to a considerable extent over an area of eight or ten square miles, but the loss would not probably exceed two per cent. of the hogs in the county. Cholera has also prevailed to a like extent among chickens.

Russell.—The only serious loss occasioned among farm animals by disease in this county the present year has been occasioned by cholera among hogs. Carbolic acid, when given according to directions recommended by your Department, has proved a very efficient preventative, and somewhat of a remedy.

Sumter.—But little disease of any kind has prevailed among farm stock the past year. More animals have died from poverty and bad treatment than from disease.

Talladega.—Farm stock has been unusually healthy the past year. Although hogs and poultry are never entirely free from cholera, the disease has not prevailed as an epidemic this year. A disease more fatal than cholera has prevailed among poultry, having killed on two farms near us all the turkeys and ducks and about all the chickens. The symptoms are paralysis of the limbs and neck. None attacked recovered.

Wilcox.—There has been no prevailing disease among horses this year. Cattle have also remained healthy. Cholera among hogs and fowls has prevailed to a considerable extent, and has proved quite fatal.

ARKANSAS.

Arkansas.—Horses and cattle have been afflicted to some extent with diseases incident to them during the year. The value of horses lost will not exceed \$2,000. Disease carried off cattle to the value of perhaps \$1,600, and hogs probably to the value of \$1,000.

Baxter.—A disease generally known as blackleg has prevailed to some extent among cattle. It is generally very fatal. Perhaps 100 head, valued at \$1,000, have been lost by the disease. About 50 head of horses have died during the year from disease and other causes.

Calhoun.—An unknown disease, causing blindness, prevailed among our cattle. Sometimes it affects but one eye, at others both, causing complete blindness. Those that were affected last year are still blind and show no signs of improvement. Chicken cholera carries off about 30 per cent. of our fowls every year.

Crawford.—The only epidemic disease that has prevailed in this county has been among hogs and fowls. In one locality a number of hogs have died with what is supposed to be cholera. They included all ages. The value of the losses will reach \$1,000. Upon inquiry I have found two farms on which chickens have been lost by cholera. One farmer tells me that his chickens commence dying as soon as his flock increases to 200 or more. Cattle and horses are very healthy.

Craighead.—I hear of no complaint of the prevalence of disease among farm animals except that of cholera among hogs. I think the loss will reach one-third of this class of animals in the county. But for this disease we would have had pork to export.

Dorsey.—Cattle, hogs, sheep, and fowls have been unusually healthy this year, no destructive disease having appeared among them. A considerable number of horses have been affected with blind-staggers. All those attacked have died.

Drew.—There has been no disease of any kind affecting farm stock in this county the past year. The number of hogs in the county has increased perhaps 50 per cent. Cholera has prevailed among chickens to some extent.

Franklin.—No contagious epidemic has occurred among either horses or cattle the past year. A horse has occasionally died of bots, blind-staggers, and colic. Cholera has prevailed among hogs, but not to any great extent. Cholera has also appeared in a limited degree among fowls.

Garland.—There has been no epidemic of any kind among our stock this year, hence the losses have been light.

Grant.—The only losses that have occurred from disease among our farm animals during the past year have been confined to hogs, and the aggregate has been so small that it is hardly worth recording.

Hempstead.—No serious disease has prevailed among horses, mules, cattle, and sheep in this county during the year. Quite a number of hogs have died from the usual diseases.

Marion.—No contagious or epidemic disease has visited any class of our farm stock the past year. This is a fine county for farm animals, and they are usually healthy.

Mississippi.—We have been very fortunate with our farm animals the past year. We have had no disease of any kind among them.

Montgomery.—Horses have not been afflicted with any disease of consequence the past year. Cattle and sheep are always healthy. A few hogs have died, and a few chickens have been lost by the usual diseases.

Newton.—So far as I have been able to learn, I can state that stock of all kinds in this county is in a healthy condition. There has been no unusual sickness among any class of farm animals for the past two years.

Phillips.—Horses and mules valued at perhaps \$6,000 have died during the year, but in most cases the losses were occasioned by abuse and bad treatment on the part of laborers. The value of the losses among cattle will reach about \$2,000, and that among hogs between \$600 and \$700. A great many more sheep are annually killed by dogs than die of disease. The average quality of all farm animals in this county is low.

Pope.—The greatest loss we have sustained from disease has been from cholera among hogs and fowls. Perhaps \$5,000 will cover the losses among hogs, and \$500 the losses occasioned among fowls.

Poinsett.—Neither horses, cattle, sheep, hogs, nor fowls have been visited by any epidemic disease for the past twelve months. We suffered heavy losses from hog cholera in the year 1882. It was estimated that fully 25,000 died that year in this county.

Prairie.—We have had to contend against no disease among our farm animals the past year. Fowls have been afflicted to some extent, but I presume \$200 would cover the losses.

Pulaski.—All kinds of farm animals, including fowls, have been very healthy the past year.

Saline.—Animals of all kinds in this county maintained unusually good health in 1882, and I have no epidemic to record as having prevailed among any class the present year.

Sharp.—No disease worthy of being reported has occurred among hogs, sheep, or fowls in this county for several years. Some five or six cattle have died in one section of the county within the past fortnight, with a disease resembling dry murrain. The disease, whatever it is, is not spreading.

CALIFORNIA.

Amador.—For three months past an epidemic has raged among cattle in this county. The disease is black-leg. It attacks those of the young stock in the best condition, particularly those pastured in the Sierras during the summer. All attacked die. The exact number that have been lost cannot be ascertained. Two of my neighbors have lost 12 or 15 head each. No doubt not less than 100 have died. Their average value would be about \$15.

Calaveras.—I estimate the value of farm animals lost by disease in this county the past year as follows: Horses, \$6,000; cattle, \$7,500; swine, nominal; sheep, \$2,000. The principal disease among sheep is scab.

Contra Costa.—Horses have suffered to some extent from pneumonia and epizooty, and cattle from big-head or rotten-jaw. A good many fowls are lost from a disease supposed to be enlargement of the liver. Stock generally seem to be in good health.

Placer.—The only disease that has affected any class of farm animals the past year has been scab among sheep. The losses from this cause have been light.

Plumas.—As regards diseases of cattle, the only thing we have suffered from has been black-leg. Only young cattle—calves and yearlings—have been attacked by this disease. The mortality has been greatest among thoroughbred stock.

San Diego.—The most fatal disease among horses can hardly be explained. When they run out they eat what is known as the "crazy-weed," from the effects of which many of them die. Black-leg has prevailed to a considerable extent among cattle. The losses have been heavier this year than ever before. Hogs have suffered some, but not to the extent of other classes of animals. It has been rather an unfavorable year for sheep. Fowls have suffered with all the diseases incident to them.

Solano.—There are no prevailing or contagious diseases among any of the domestic animals in this county, and there are no losses to record other than those that might be expected where such animals are ordinarily healthy.

Ventura.—Farm animals have been very healthy in this county the past year. Sheep are the only animals that have been affected, and the value of the losses in this class will reach \$5,000 or \$6,000.

Yuba.—Perhaps \$3,000 will cover the value of losses among all kinds of farm animals in this county during the past year from the various diseases which affect them.

COLORADO.

Center.—There is not now, nor has there been for the past two years, any disease of a general character among the farm stock or fowls of this county.

Mesa.—All farm stock has been remarkably healthy the past year; no disease whatever. Can hear of no losses, except by accident.

Larimer.—No disease of any kind prevails among farm stock in this county. I cannot learn of the loss of any animal by disease during the year.

CONNECTICUT.

Fairfield.—I give the value of the losses of farm animals in this county for the year as follows: Horses, \$5,000; cattle \$2,500; hogs, \$300; sheep, \$750; and fowls, \$1,000.

Litchfield.—I suppose 20 per cent. of the horses in this county were afflicted the past year with colic, distemper, or more serious diseases, and that one-third of those so afflicted died. Ten per cent. of our cattle have suffered with murrain, milk fever, tuberculosis, and lung worm in calves. About one-half of those attacked died. Hogs die of surfeit, cholera, &c. About all die that are attacked by disease. Sheep have been afflicted with lung worm, tuberculosis, &c., and fowls with cholera, roup, and gapes. I give the following estimate of the value of our losses for the past year, viz: Horses, \$25,000; cattle, \$81,000; hogs, \$10,000; sheep, \$975; fowls, \$4,500.

New London.—There has been no epidemic of any kind among our domestic animals that has proved generally fatal; simply pink-eye among horses, and distemper to some extent among fowls. The losses have been comparatively light.

Tolland.—But few losses have occurred in this county by sickness among farm animals. The cases that occur are of the usual maladies.

Windham.—Farm animals in this county have been unusually free from all kinds of diseases during the past year.

DELAWARE.

New Castle.—Horses, cattle, sheep, and hogs now enjoy an entire exemption from epidemics, and the returns show a gradual increase in numbers. One deplorable fact exists, and that is the large shipment of calves to market. An ambition to possess thorough-bred cattle has seized some of our best farmers in Kent County, and imported cattle seem to have become a necessity to a large number. The Alderney and Guernsey breeds are favored. With the investment of large sums of money in "blooded" cattle comes a greater amount of care in their keeping, such as the feeding of chopped feed, meal, oil cake, &c., when but a few years ago straw and coarse

fodder were about the only food given. Better care in every way is now taken with the animals, and they are furnished with comfortable sheds for inclement weather. Pumps in the inclosure with clean troughs and pure water instead of that which formerly stood in the muddy, stagnant water-hole, and good clover fields for pasture instead of the turned-out and exhausted lands or wood-range. Our cows often go to the pail at eighteen months of age instead of three years, as formerly.

FLORIDA.

Alachua.—No destructive disease has prevailed among any class of farm animals in this county in the past year, though a great many fowls has been lost by cholera.

Bradford.—Horses have been afflicted with staggers, cattle with black-tongue, hogs with cholera, sheep with scab, and fowls with cholera. These are the most fatal diseases, and have destroyed horses to the value of \$15,000; cattle, \$2,500, and hogs perhaps to the value of \$1,000. The health of farm animals and fowls has been good considering the care given them.

Brevard and Orange.—Horses, cattle, and hogs have been afflicted with the usual diseases the past year. I estimate the value of the losses about as follows: Horses, \$3,000; cattle, \$5,400; and hogs, \$300. Sheep and fowls have remained healthy.

Clay.—A great many cattle have died of hollow-horn, hogs of cholera, and fowls of swell-head. Hogs to the value of \$20,000 have been lost. Perhaps the value of fowls lost would reach \$3,000.

Columbia.—A good many horses have died of staggers, brought on no doubt by summer pasturing in shadeless ranges. Cattle have been lost by flux, hogs from cholera and thumps, sheep from what is known here as rot, and fowls from cholera and sore-head. I think the value of our losses have been about as follows: Horses, \$2,000; cattle, \$40; hogs, \$3,750; and fowls, \$200.

Dade.—Neither farm animals nor fowls have been attacked by any epidemic or contagious disease during the past year. We have but little farm stock in this county.

Hernando.—Some epizootic diseases have prevailed among horses recently brought to this county from Kentucky and Tennessee. The malady is the result of a change of climate.

Hillsborough.—I have not heard of the prevalence of diseases among any class of farm animals the past year, except distemper, which affected a drove of horses brought in from Kentucky. But one animal died.

Jackson.—It is only at certain seasons of the year, and in certain localities of the county, that farm animals suffer with disease. Our losses have been light the past year.

Madison.—The principal disease among horses and mules are colic and staggers. These diseases cause quite a heavy annual loss. Hogs valued at \$2,500 have died during the year of cholera and thumps. Burned corn is a preventive of cholera, it is said.

Marion.—Horses, cattle, and hogs are subject to such diseases as colic, blind staggers, and cholera, the latter being confined to hogs. Cattle in some localities are troubled with a disease known as salt-lick. It is manifested by a slow debility, and is sometimes accompanied by diarrhea. No remedy has been found for the disease.

Santa Rosa.—A few horses died during the year in this county. A large number of cattle died in the spring of 1882, mostly from starvation. Very few hogs have been lost by disease this year, but more sheep than usual have died. Cholera has been very destructive to fowls.

Suwannee.—Horses and mules die of blind staggers, sand, and colic. No glanders or farcy, but almost every horse that sickens of either staggers or sand disease dies. A great many cattle have been lost, and a great many hogs have died, I suppose of cholera. The same can be said of fowls. I estimate the value of our losses as follows: Horses, \$15,000; cattle, \$12,000; hogs, \$2,300; sheep, \$200; fowls \$600.

Taylor.—All I have been able to learn is that a few horses have died of blind staggers, and some hogs have died of cholera. There is but little farm stock in this county.

GEORGIA.

Baldwin.—We have more mules than horses in this county. The only deaths among either class have been caused by colic. No epidemic has occurred. There have been but very few cases of cholera among hogs. No disease among cattle to cause serious loss; a few deaths here and there.

Brooks.—Horses, cattle, and sheep have been generally healthy. For the past eight or ten years our hogs and chickens have died at a rapid rate from cholera.

Burke.—Only one epidemic of glanders among horses has been reported during the past eighteen months. The disease was brought from 20 miles west of here, and was confined to one public stable. Cattle and sheep have been healthy. About one-half of the hogs and two-thirds of all the fowls in the county have been lost during the year by the cholera.

Camden.—Neither horses, cattle, sheep, nor hogs have been affected by contagious diseases the past year. Cholera has destroyed a great many fowls.

Campbell.—No destructive disease has visited any class of our domestic animals or fowls during the current year.

Carroll.—I am unable to hear of the prevalence of any epidemic disease among farm animals in this county the past year. Cholera has prevailed among fowls, but to no great extent.

Catoosa.—Hog cholera has been simply awful in this county this year. No remedy was efficient, but preventive measures were somewhat serviceable. Our hogs have been singularly exempt from disease heretofore, but we have been scourged at last.

Charlton.—A few horses have been lost the past year by the usual diseases. The greatest and only loss from contagious or epidemic diseases has been among hogs, caused by the disease known as cholera.

Chatham.—No disease of an epidemic character has existed among any class of farm animals in this county during the year just closing.

Chattooga.—Horses and cattle have been unusually healthy the past year. A few hogs have died from what was thought to be a mild type of cholera, but the disease was not marked with its usual malignancy and fatality.

Cobb.—The total loss of farm animals and fowls from disease in this county the past year will aggregate about \$5,000. There has been no extensive outbreak of disease except among hogs and fowls, and among these the destruction has not been so great as in many former years.

Coffee.—A few horses have died the past season of staggers. Cattle have been healthy, though some have died from poverty and neglect. Hogs have been afflicted with cholera, but the losses have not been heavy.

Colquitt.—There have been no losses among farm animals this year except from common casualties, old age, &c.

Dade.—I think \$1,000 will cover all the losses of farm animals in this county the past year from the various diseases to which they are subject.

Dawson.—There have been a less number of deaths among horses and mules the past year than usual. The same can be said of cattle. Hog cholera has been very fatal in some portions of the county, but the disease has not prevailed generally. But little attention is paid to the raising of sheep.

Dooly.—Not a case of contagious disease has occurred among farm animals in this county the past year so far as I am able to learn. Sheep have suffered to some extent from dogs.

Early.—I estimate the value of the losses among the principal classes of farm animals as follows for the current year: Horses, \$2,500; cattle, \$500; hogs, \$1,000.

Effingham.—With the exception of hogs and fowls, all kinds of farm animals in this county are in a healthy condition.

Emanuel.—The only epidemic we have had to contend with for some years past is cholera among hogs. These animals are more or less affected with this or some other disease every year. A few horses have died of staggers, and a good many for lack of proper care and attention. They are kept on the range through the winter, and often die from hunger and exposure. I estimate the value of horses lost at \$7,500; hogs, \$2,500; sheep, \$3,500.

Fannin.—With the exception of a few cattle that have died of milk-sickness, farm animals in this county have enjoyed exceptionally good health the past year.

Franklin.—There have been no contagious diseases prevalent among farm animals since 1872. During that year about 50 per cent. of all the hogs in the county died of cholera. A few horses have died the present year from neglect and bad treatment.

Fulton.—There are but a limited number of farm animals raised in this county for market, and I have but few losses to record. Our hogs were formerly affected with cholera, but since the adoption of the stock law we have had no trouble from it.

Gilmer.—I estimate the value of farm animals and fowls lost in the county the past year as follows: Horses, \$4,000; cattle, \$1,000; hogs, \$1,000; sheep, \$225; fowls, \$120.

Gordon.—This has been an exceptionally healthy year for farm stock. A few cattle have died of "murrain," or Texas fever, but so very few that they are not worth recording. A good many fowls have died from so-called cholera, but it is impossible to give anything like a correct estimate of the number lost.

Greene.—I have no heavy losses to record as occurring among any class of farm animals in this county. The year has been an average one as regards the health of farm stock.

Habersham.—No special epidemic disease has prevailed among our stock the past season. The number of each class of animals has gradually increased. We have more hogs in the county than at any previous time during the past five years.

Haralson.—I think about 10 per cent. of the sheep of this county die annually of the disease known as rot. About the same proportion of fowls die of so-called cholera.

Harris.—This has been a remarkably healthy year for all kinds of stock. Our people are giving much more attention than formerly to the care of stock, and I think the business will ultimately prove profitable. We have a climate capable of a variety of productions—corn, cotton, wheat, oats, barley, rye, potatoes, vegetables, and all kinds of stock.

Hancock.—No diseases have prevailed among farm animals as epidemics; only sporadic cases now and then, confined to limited localities. Grubs have proved fatal to sheep, and cholera and "sorehead" to fowls.

Jackson.—Horses and cattle have not been seriously affected with disease during the year. Hogs and sheep have suffered to a considerable extent with contagious diseases. Thousands of fowls die annually of disease.

Jasper.—I know of no disease existing among either horses or cattle. Occasionally a horse dies of colic and a cow from neglect. Cholera has prevailed to some extent among hogs. It is said it may be avoided by letting them have free access to salt and wood ashes.

Johnson.—The only farm animals affected by disease here are hogs. The cholera never dies out among these animals. Hogs are dying now in almost every section of the county. Our losses up to this time will reach from \$5,000 to \$10,000.

Lumkin.—Horses, cattle, and sheep are healthy. Hog cholera is not so prevalent as usual. One-fifth of all the hogs in the county died of this disease in 1882.

McDuffie.—With the exception of an occasional case of colic, we rarely have any disease among our horses. Cattle are seldom affected. Hogs die of cholera more or less every year. Increased interest is being paid to stock, and the amount now raised is double that of a few years ago.

Morgan.—Nearly all labor is performed by mules, which, I suppose, outnumber the

horses four to one. No special disease prevails among them. We frequently lose many hogs by cholera, but the disease seems not to have visited the county during the past two years. Sheep are healthy. Fowls in some localities have suffered from roupe and cholera.

Muscogee.—This is not a stock-raising county, and I have no report to make relative to diseases.

Oconee.—Cattle are frequently attacked with bloody murrain and sheep with foot-rot. Hogs and fowls suffer to a greater or less extent every year with cholera.

Pickens.—The greatest losses among cattle in this county are caused by murrain and distemper. Cholera and quinsy prevail among hogs, and cholera among chickens. I estimate the value of our losses in fowls alone at \$100,000.

Quitman.—No contagious diseases are prevalent among either horses, cattle, or sheep. Recently the hogs in many localities have been attacked with cholera, which seems to be unusually fatal. The chickens are being decimated in entire neighborhoods by the same disease.

Rockdale.—Horses, mules, and cattle have been affected with no unusual diseases the past year. Hogs and fowls, however, annually die in great numbers of the disease known as cholera. Our stock has wonderfully improved under the no-fence law, which has been in operation in the county two years.

Talbot.—Domestic animals of all classes have been unusually exempt from disease the current year. Some cholera has prevailed among chickens, which is generally checked by putting them up, a few together, and destroying the dead. Much attention is being paid to improvement in the breeds of cattle. We have the Jersey fever.

Terrell.—Horses are generally lost by poverty, or some disease induced by ill-treatment. But little small grain is raised, and the animals are fed on chaff, weevil-eaten corn, and poor fodder, which the horses cannot assimilate. The most of the work is performed by mules, and of course the losses are greater among this class. Perhaps the value of these losses will reach \$2,500 annually. No contagious diseases among cattle. What we term cholera causes heavy losses in poultry. About once in five years it almost annihilates the chickens.

Thomas.—Black-tongue or murrain occasionally carries off a few head of cattle. Blind staggers is about the only destructive disease to horses and mules. Cholera and sorehead are the diseases which afflict fowls.

Troup.—No disease has prevailed among our stock during the past year—at least the losses have been so light as not to be worthy of record.

Union.—Distemper is the only disease existing among horses, but I have heard of no deaths resulting. Milk-sick has prevailed to some extent among cattle. This is caused by a mineral poison, and is confined to particular localities.

Washington.—Not much disease among domestic animals in this county. Have no means of securing correct data.

Webster.—An epidemic prevailed among cattle in the northern portion of this county in March last. It proved fatal in almost every case. The disease was not identified. There was inflammation of the intestines, black, watery discharges, loss of appetite, and death within a few days.

White.—The only contagious disease that has prevailed among our farm stock is hog cholera. I suppose hogs to the value of \$2,000 or \$3,000 have been lost by this disease.

Wilkes.—Horses and mules suffer more from short rations than anything else. Hogs are healthy, and on the increase. Sheep suffer only from dogs.

Worth.—Staggers is about the only disease affecting horses. Those attacked scarcely ever recover. The cattle are of the scrub kind. They are generally brought from Texas to graze on our mesquit grass. A great many of them die from exposure in severe weather. We have had no rain since June. The grass is dead, and the cattle look very weak. No disease among hogs. The breed is the bottle-nose, piney woods, roter or razor back.

ILLINOIS.

Adams.—With the exception of a few cases of pink-eye in horses, no disease of a serious character has prevailed among any class of domestic animals in this county the past year.

Boone.—During the past year all kinds of farm animals have remained very healthy. The only disease worthy of note is chicken cholera. This has been very fatal in many cases. No remedy is known.

Carroll.—The largest stock-shipper in the county informs me that he has never known a time when all kinds of farm animals were so free from disease as at present. I give the losses for the year as follows: Horses, \$12,847; cattle, \$11,131; hogs, \$4,463; sheep, \$604.

Christian.—About 5 per cent. of the horses and cattle of this county are annually lost by sickness, accidents, &c. Twenty-five per cent. of the hogs and 25 per cent. of the fowls of the county generally die of some disease incident to them.

Clark.—The assessor's returns for this county give the value of the losses of farm animals for the past year as follows: Horses, \$15,718; cattle, \$4,291; hogs, \$5,205; sheep, \$1,372.

Clinton.—The following is the most accurate estimate I can give of the value of the losses among farm animals in this county for the past year, viz: Horses, \$15,669; cattle, \$4,969; hogs, \$7,098; sheep, \$1,392; fowls, \$384.

Crawford.—Many hogs have died of so-called cholera. Losses of all classes of domestic animals for the year: Horses, \$1,325; cattle, \$5,000; hogs, \$18,900; sheep, \$3,600.

Cumberland.—Farm animals have been in better health the past year than usual! I think the following estimate will cover the value of losses among all classes as well as fowls: Horses, \$3,000; cattle, \$450; hogs, \$5,000; sheep, \$2,000; fowls, \$400. There has been some distemper among horses.

De Kalb.—Farm animals have enjoyed remarkably good health this year. I think the aggregate value of the losses will not exceed \$4,000.

Edgar.—Colic, bots, distemper, &c., occasionally cause the death of a horse. There is no general disease among cattle and but little among hogs. The following is an estimate of the value of the losses among the various classes: Horses, \$12,000; cattle, \$5,000; hogs, \$3,000; sheep, \$300; fowls, \$1,000.

Edwards.—Hogs to the value of \$3,000 or \$9,000 have been lost the past year by farmers of this county. A few horses and cattle have also died of diseases incident to them.

Franklin.—Aside from the ravages caused by hog cholera, I have no losses to record among other farm animals. The value of the losses caused by the above disease will reach \$3,000.

Fulton.—Hog cholera prevails in the county, and many cases have terminated fatally. No other class of animals seems to be seriously affected.

Gallatin.—Perhaps 100 head of horses have died in this county of fistula. Cattle have been extremely healthy. Murrain and mad-itch have probably caused the death of 50 head. Some cholera has prevailed among hogs, from which about 700 head have died.

Grundy.—All classes of farm animals and poultry have been exceedingly healthy the past year. The losses by infectious and contagious diseases will not exceed one per cent. in either class.

Henry.—Some horses and cattle have been lost by accident and disease. Hogs are healthier than last year, though the value of our losses for the current year will reach \$15,000. Cholera has swept off fowls to the value of \$1,500.

Jefferson.—The only loss of consequence among our farm stock has occurred among hogs. I suppose \$4,000 or \$5,000 will cover the loss of these animals.

Jersey.—The assessors for this county make the following returns of the value of

farm animals lost in 1883: Horses, \$10,275; cattle, \$16,705; hogs, \$5,000; sheep \$1,148.

Johnson.—Some cattle brought into this county from the south were affected with disease and a few of them died. No losses worthy of mention among other animals.

Jo Daviess.—The value of the losses of farm animals in the county for the year 1883, with slight modifications is given by the assessors as follows: Horses, \$21,990; cattle, \$16,705; hogs, \$42,789; sheep, \$1,114.

Kankakee.—But little disease of any kind seems to have prevailed among any class of our farm animals the past year. From the best information I can get I am led to believe that the losses among all classes will not exceed \$1,200 in value.

Kendall.—Hogs to the value of \$15,540 have been lost by disease in this county during the past year. A few flocks of sheep have been afflicted, but the losses have been light.

La Salle.—A few horses died in this county last spring of hysteria. During the summer a disease attacked the cows near Mendota. It was very fatal, and killed the animals in a few hours. A good many hogs died in the course of the farrowing season. I hear of but one flock of sheep affected with scab.

Lawrence.—Horses and cattle are healthy. Hogs have suffered with cholera as usual. A great many sheep have died of a disease of the bowels. Large numbers of fowls have been destroyed by cholera.

Lee.—As a general thing farm animals have been quite healthy the past year. A few hogs have been lost from various causes; but the value of the losses will not exceed \$1,600 or \$1,800. Some foot-rot prevails among sheep, but the disease is not destructive.

Mason.—Some pink-eye has prevailed among horses, and a mild type of cholera among hogs, but the losses have been very light. Other classes of stock have remained healthy.

Morgan.—No new disease has prevailed among any class of farm animals the past year. Cholera among hogs and fowls is about the only disease that has caused losses worthy of mention.

McHenry.—The following are the number and value of farm animals lost in this county the past year, as shown by the returns of the assessors: Horses, \$15,702; cattle, \$12,879; hogs, \$5,230.64; sheep, \$2,269; and fowls, \$900. The heaviest losses among all kinds of stock occurred during the months of March and April. No contagious diseases seem to be prevailing at this time.

Ogle.—While no epidemic seems to have prevailed during the year among our farm animals, the losses have been quite heavy. The value of the losses is given as follows: Horses, \$16,000; cattle, \$19,800; hogs, \$3,900; sheep, \$432.

Peoria.—The losses among domestic animals in this county were quite heavy during the year. They are given as follows: Horses, \$29,186; cattle, \$10,014; hogs, \$20,580; sheep, \$2,330. Of the hogs lost 2,895 died of cholera and 1,203 of other diseases.

Perry.—Perhaps \$8,000 or \$10,000 will cover the value of the losses of farm stock in this county during the year from all causes.

Pulaski.—After the high waters of last spring subsided a disease appeared among hogs which seemed to have its origin and to more seriously affect those that had been kept in crowded pens and ill provided places during the continuance of the flood, and were returned to the ground before it had sufficiently dried. In some instances those that recovered changed their color from black to gray.

Utam.—During the year we lost 91 head of horses, 106 head of cattle, 596 hogs, and 79 sheep, valued as follows: Horses, \$9,359; cattle, \$2,931; hogs, \$3,576; sheep, \$400.

Pope.—All classes of farm stock seem to be healthy—no disease of consequence the past year. In 1882 663 hogs died of cholera in this county, and 893 sheep were destroyed by dogs.

Rock Island.—Quite a large number of hogs have been lost by the usual diseases the past year. The losses among other classes of animals are hardly worth recording.

Saline.—The loss of domestic animals by disease has not been very great in this county the past year. I give the value of the losses among the various classes, as follows: Horses, \$1,995; cattle, \$693; hogs, \$2,407.50; sheep, \$480. Fowls are healthy.

Schuyler.—Seven horses affected with glanders have been condemned and destroyed by order of the State veterinarian, and five others are supposed to have the disease. These will be finally examined by the veterinarian on his return to the county. Other classes of farm animals are healthy.

Shelby.—Farm animals in this county have been unusually healthy the past year. No epidemic of any kind has prevailed. The value of the hogs lost is estimated at but \$2,054.

Stark.—Only the ordinary diseases have prevailed among our horses and cattle the past year. Sheep have also been healthy, and hog cholera has been less destructive than for many years past.

Stephenson.—Notwithstanding there has been no special epidemic among horses, I estimate the value of those lost in the county the past year by ordinary maladies at \$35,000. The value of the other classes of animals that have died of disease or by accident I give as follows: Cattle, \$3,600; hogs, \$1,500; sheep, \$1,000.

Saint Clair.—But few farm animals are kept in this county, and what we have are kept in the best possible condition, hence they are scarcely ever visited by epidemics.

Tazewell.—No severe epidemic has prevailed among any class of farm animals in this county the past year. Even swine plague has prevailed to a less extent than formerly.

Vermillion.—The health of all classes of domestic animals has been unusually good the past year. What losses have occurred have been small and were the result of natural causes. A few hogs died in one township of the cholera; the loss was insignificant.

Wayne.—Farm animals valued as follows have been lost by the farmers of this county the past year, viz: Horses, \$1,800; cattle, \$975; hogs, \$1,680; sheep, \$280 and fowls, \$2,250.

Wabash.—Pink-eye prevailed among horses not long since in one locality in our county, but I heard of but one death from the disease. Cattle and sheep have been healthy. A few hogs were reported as having died late in the fall.

Warren.—One hundred and twelve horses are reported as having died in this county the past year. They were valued at \$6,720. One hundred cattle, valued at \$20 per head, were also lost.

Will.—The value of the losses among farm animals in this county for the current year are given as follows: Horses, \$1,360; cattle, \$8,000; hogs, \$2,400; sheep, \$312.50.

Williamson.—Carts that had been used for transporting cattle to Saint Louis were brought to this county to be loaded with coal. The manure was thrown out alongside the railroad track, and all the cows that visited the locality were infected with Texas fever and died.

Winneshaw.—The county assessors return the following as the value of losses among farm stock for the year: Horses, \$11,512; cattle, \$8,196; hogs, \$9,112; sheep, \$720; and fowls, \$1,858.

INDIANA.

Adams.—No disease has prevailed during the year among either horses or cattle in this county, but some hogs have died of cholera. This disease has been neither so widespread nor destructive as in 1882.

Benton.—Some few cattle died during the year with pink-eye. We can't depend on the health of our hogs from one week to another. They are now suffering with the old-fashioned cholera. Sheep have died of foot-rot and scab, and a great many fowls have been lost by cholera.

Clinton.—The value of the losses among domestic animals in this county for the year, from the various causes and diseases incident to them, is about as follows: Horses, \$12,650; cattle, \$10,000; hogs, \$6,000; sheep, \$1,000; and fowls, \$450.

Crawford.—Farm animals in this county have remained in good health during the year. No epidemic of any kind has prevailed among them.

Decatur.—The loss of animals in this county has been very heavy, though no general epidemic is reported as having prevailed among any particular class. Fowl cholera has been particularly destructive, so much so as to discourage poultry raisers. The value of the losses for the various classes are estimated as follows: Horses, \$17,570; cattle, \$4,200; hogs, \$16,107; sheep, \$2,208; mules, \$2,400; and fowls, \$2,500.

Dubois.—Hogs are the only domestic animals that seem to have been seriously affected by disease during the past year. The value of those that have died amount to \$9,462. Chicken cholera has carried off fowls valued at \$2,856.

Fayette.—No disease of a destructive character has prevailed during the year among either horses, cattle or sheep. Hogs valued at from \$6,000 to \$7,000 have died of the usual diseases.

Franklin.—I know of no particular disease to which horses have been subject. About 75 per cent. of the hogs lost during the year died of swine plague, and about 40 per cent. of the losses among sheep were caused by dogs. About 20 per cent. of our fowls have died of cholera. The total value of the losses among hogs aggregates \$20,956. The results of the experiments made by the Department through its agencies in the treatment of swine plague have been thoroughly tested here during the past year, and no advantage seemed gained either in cure or prevention. Hog cholera, when malignant, yields to no known remedies with us. It is wholly unmanageable and fatal.

Fulton.—The county assessors give the following as the value of the losses among farm animals in this county for the past year: Horses, \$12,400; cattle, \$4,400; hogs, \$7,500; sheep, \$600.

Gibson.—The records in the county auditor's office give the following losses of farm animals for the year: Horses, \$17,800; mules, \$6,975; cattle, \$6,540; hogs, \$33,710; sheep, \$752.

Harrison.—No destructive epidemic of any kind has visited the domestic animals of this locality during the year. I have no means of securing the statistics of losses of those that have died.

Hamilton.—A great many cows have died of milk fever. The disease is very fatal, and about all die that are attacked. Quite a number of hogs have died in the county of late. If one of these animals die the disease is always called cholera. I estimate the value of those lost, whether by cholera or some other disease, at \$12,800. Cholera and gapes frequently prove very destructive to fowls.

Hancock.—No disease of consequence has prevailed among horses, cattle, or sheep the past year. With a few exceptions hogs have been healthy, and the aggregate loss will not much exceed \$8,000. Whenever any disease prevails among this class of animals it is called cholera. A disease also called cholera and roupe have prevailed to some extent among chickens.

Hendricks.—Losses of animals in this county for the year 1883 are given as follows: Horses, \$8,750; cattle, \$4,820; hogs, \$12,565; sheep, \$2,290.

Henry.—It is difficult to answer the desired questions. In some localities there have been heavy losses from hog cholera, but as to the value of the losses I am at a loss to know. Two men near here have lost about \$1,000 worth each and others quite largely. No disease has occurred among horses or cattle.

Howard.—No epidemic disease prevailed among horses during the years 1882-'83. Anthrax prevailed to some extent among cattle, destroying animals valued at upwards of \$5,000. I estimate our losses by so-called hog cholera at \$30,000. This disease prevails among hogs throughout the year.

Jay.—Occasionally pink-eye appears among our horses and distemper rages to

some extent, but the losses are generally light. Our county has again been visited by hog cholera in its worst form. Some farmers have lost nearly all their animals. Nothing seems to have any effect on the disease when it gets a fair hold; the animals die anyhow. Chickens also die in large numbers of cholera. Sheep are fearfully slaughtered by dogs.

Jennings.—The only disease worth mentioning among farm animals is hog cholera. This disease, however, is not so widespread and destructive as in some former years. Last year I lost 70 head myself by the disease.

Johnson.—The records in the auditor's office give the following as the value of farm animals lost during the year, viz: Horses, \$1,250; cattle, \$300; hogs, \$5,000; sheep, \$1,200; and fowls, \$250.

Knox.—The most careful estimates give the value of farm animals lost in this county during the year as follows: Horses, \$1,000; cattle, \$5,000; hogs, \$25,000; sheep, \$1,262.

Lagrange.—No special disease has prevailed among our horses or cattle. Cholera had destroyed hogs perhaps to the value of \$5,000. The actual loss by death and hindrance in reproduction is no doubt greater than this; in all probability it would reach \$10,000. As a preventive of this terrible disease carbolic acid and turpentine in swill or feed has been found the most efficacious.

Madison.—Cholera has prevailed among hogs in some portions of this county, and has destroyed animals during the year worth in the neighborhood of \$10,000. Other classes of animals have been measurably healthy.

Marshall.—The following figures represent the losses of farm stock in this county for the past year: Horses, \$7,000; cattle, \$3,200; hogs, \$3,200; sheep, \$350; and fowls, \$2,777.50.

Miami.—No epidemic disease has visited either horses, cattle, or sheep. The number of sheep killed by dogs was 390, valued at \$1,462. The value of hogs lost by the diseases incident to them was \$31,400.

Morgan.—None other than ordinary diseases have affected our stock during the past year. There has been a slight sprinkling of cholera among both hogs and fowls, but it is hard to determine the actual loss as regards either numbers or values. Perhaps one-third of the chickens hatched have died of the disease.

Monroe.—No epidemic disease has prevailed among horses. A few animals have died of pink-eye and distemper, and others of old age, colic, bots, bad treatment, &c. No disease among cattle or sheep, except foot-rot among the latter, caused by keeping too many animals together. In some neighborhoods the hogs have suffered from swine-plague.

Parke.—Hogs have died with the usual diseases the past year. The number that died is given at 4,285, valued at upwards of \$20,000. The loss among sheep has also been quite heavy.

Ripley.—The following figures represent pretty accurately the value of domestic animals lost in this county the past year: Horses, \$11,075; cattle, \$3,104; hogs, \$4,165; sheep, \$1,550.

Scott.—Perhaps \$5,500 would cover the value of the losses of hogs during the past year. Chicken cholera has been very destructive. Quite a number of fowls have also died of fatty degeneration of the heart. The heart seemed to be transformed into a lump of fat. This ruptures, and the fowl dies almost instantly.

Shelby.—The mortality among domestic animals in this county has been quite heavy the past year. Cholera among hogs and fowls has proved more destructive than any other disease.

Spencer.—Some young horses have died of distemper. A great many hogs have died of cholera. About all that are attacked by this disease die. Cholera and gapes have destroyed a good many fowls.

Switzerland.—Sixty-six horses died in this county during the year. Of these about 5 per cent. died of pink-eye. Mr. Perry Colton lost 17 head of cattle by an unknown

disease. Frequent deaths have occurred among hogs from cholera and among sheep from rot.

Tippecanoe.—With the exception of cholera among hogs our farm animals have been very healthy the past year. No disease of any kind is prevailing at present.

Union.—About 1,200 head of hogs have died in this county during the year, valued at \$7,800. Diseases have also been very destructive to fowls.

Vigo.—No epidemic has prevailed among farm stock in this county the past year. The following values of the losses are the result of deaths from ordinary diseases and accidents, viz: Horses, \$16,350; cattle, \$7,590; hogs, \$5,360; sheep, \$816; and fowls, \$320.

Wabash.—A great many animals died of the various diseases to which each class is subject during the year. The value of the losses are about as follows: Horses, \$12,960; mules, \$1,700; cattle, \$12,810; hogs, \$19,456; sheep, \$1,424.

Wayne.—Cholera proved very disastrous to hogs in this county during the year. The number reported as having died of the disease was 9,253, valued at \$92,530. Some cattle died of murrain and sheep of liver-fluke. Fowls suffered from cholera.

IOWA.

Adair.—No destructive disease has prevailed among any class of farm animals in this county for the last two years.

Allamakee.—Farm animals have generally continued in good health the past season. In some localities diseases have prevailed among hogs, but not to the sweeping extent of the years 1880-'81. The same might be said as regards fowls. Some 2,800 hogs have died, valued at \$14,000.

Bremer.—As to diseases affecting different kinds of farm animals, I frequently hear it remarked that cattle, horses, and hogs were never more free from disease than they have been the past year. One assistant says: Now and then a calf dies with what is known as black-leg, but these deaths do not amount to one in fifty.

Buchanan.—The following figures represent the value of the losses among farm stock in this county for the year 1883: Horses, \$15,000; cattle, \$3,750; hogs, \$7,500; sheep, \$180. The mortality among horses was mainly caused by influenza. Abortion has prevailed to a considerable extent among cows, and has caused some deaths. No remedy or prevention is known. Hogs have died of the disease known as cholera.

Butler.—The only epidemic disease that has prevailed among any class of animals has been that among hogs. I think the value of the animals lost will not exceed \$4,000.

Calhoun.—A disease recently broke out among cattle in one of the townships of this county, which resulted in the death of a number of animals. The disease was black-leg, or something similar. Cholera has prevailed among fowls, but to no great extent.

Cedar.—Our horses have been afflicted with pink-eye and distemper. Cattle, as a rule, have been quite healthy. A few cases of black-leg have occurred. Cholera, or some kind of lung complaint, caused by worms and neglect, have caused the loss of a great many hogs. Some rot has prevailed among sheep.

Chickasaw.—The disease most prevalent among hogs seems to be hard to name and equally as difficult to prevent. In some places it is called quinsy, and in other localities cholera. But it does not prevail among our hogs to so great an extent as in other years. In a limited area of our county during the fall months horses were afflicted with an influenza which it was feared at the time would prove very disastrous, but I believe it has entirely abated.

Clinton.—As a general thing all kinds of farm animals in this county are in good health. Hogs valued at \$4,000 have been lost during the year by the usual diseases.

Crawford.—I estimate the value of the losses of farm stock in this county the past year as follows: Horses, \$3,100; cattle, \$1,560; hogs, \$3,600; sheep, \$200.

Davis.—We have been very lucky with our stock this year, no disease of any kind worthy of mention. About 800 sheep have been killed by dogs.

Decatur.—Never in the history of the county have farm animals been so generally healthy. Every assistant makes the same report. I believe this result is attributable to the shortness of grain to feed with.

Delaware.—Horses and cattle have been healthy, but hogs have suffered to some extent with the usual diseases. Animals perhaps to the value of \$5,000 have been lost.

Dubuque.—The only disease that has prevailed among any class of domestic animals in this county the past year has been the disease known as cholera among hogs. I cannot give the number or value of those lost.

Emmet.—The losses among farm animals in this county have been so insignificant for the past year that they are not worth recording.

Fayette.—A few herds of hogs have been affected by disease, but the losses have been comparatively light. No disease has prevailed in an epidemic form.

Floyd.—Epizootic influenza has prevailed to some extent among horses, and a few cases of glanders have been reported. Cattle have suffered with lung diseases and hogs with cholera. The losses, as to value, have been about as follows: Horses, \$9,000; cattle, \$3,750; hogs, \$7,500.

Greene.—Horses, cattle, and sheep are in good health. The prevailing disease among hogs and fowls is that known as cholera. The value of the hogs lost by this disease is about \$4,000, and chickens about \$900.

Hardin.—Some cholera has prevailed among hogs and fowls. Sometimes this disease will carry off almost every hog one farmer will have, while those of a neighbor will not be affected. I think \$6,000 a fair estimate of the value of those lost by the malady.

Henry.—No disease among farm animals, and no losses except from old age, accident, &c.; cholera prevailed among fowls during the months of July, August, and September.

Ida.—One thousand dollars will, perhaps, cover the losses among hogs by disease. No other class of animals have been afflicted in this county the past year.

Iowa.—Farm stock has been unusually healthy the past year. No epidemic has prevailed. Common diseases, neglect, and accident have caused about the usual losses.

Jasper.—The only disease worthy of notice is that prevailing among swine and fowls. The per cent. of disease among the former will not exceed 2 per cent., and among the latter about 5 per cent.

Jefferson.—Chicken cholera prevails to a greater or less extent every year, and the losses from this cause are often very serious. Farm animals generally are in good health.

Lee.—Among horses there has been no epidemic of note for several years. We hear occasionally of a case of pink-eye, colic, bots, and meningitis. Cattle have also been affected to some extent this season with pink-eye. Calves frequently die of black-leg. Sheep are more frequently troubled with scab than any or perhaps all other diseases. Grub in the head kills its proportion. Some sheep died of hoven during the two past wet seasons. Fowls have been subject to but one disease—that known as cholera—and this frequently depopulates whole farm-yards of chickens and turkeys. Almost all epidemics among domestic animals are confined to smaller areas than formerly; sometimes to but one farm, section or township. A few years ago, hog and chicken cholera generally extended over one or more States. Black-leg in cattle was never so general or wide-spread as now.

Linn.—No epidemic has visited horses, but the vast number of unsound ones is appalling. The number of halt, blind, ring-boned, spavined, &c., is astounding to a close observer. A few cattle have died of ordinary diseases. Some little cholera among chickens.

Marion.—During the past three months influenza has been destructive to many

young hogs. Swine plague has also prevailed in certain localities. Scab and foot-rot have caused losses among several different flocks of sheep.

Michell.—Domestic animals generally are healthy, and have been so throughout the year. The diseases that have prevailed from time to time have been the usual well-known maladies. The value of the losses are estimated as follows: Horses, \$8,350; cattle, \$5,000; hogs, \$2,500; sheep, \$250.

Monona.—Some cattle have died of black-leg during the year. Some little disease has prevailed among hogs, but the losses have been light.

Monroe.—No contagious diseases have prevailed among any class of domestic animals in this county during the year except black-leg among calves. These cases have been few. Cholera has killed a great many fowls.

O'Brien.—For two seasons our horses have suffered from an epizooty. It left many with a running at the nose. In careless hands the discharge has run along until many horses here are suffering from an offensive nasal disease called every name between bad cold and glanders.

Palo Alto.—Farm animals generally are healthy. I have not heard of a case of contagious disease among hogs for the past year.

Plymouth.—Horses in some localities in this county are said to have chronic glanders, which is causing some excitement. A disease called measles has prevailed among hogs, causing some losses.

Pottawattamie.—Last spring, in one neighborhood in the county, a new and quite strange disease appeared among both horses and cattle. It was pronounced "button-farcy" in horses. The symptoms were similar in cattle.

Shelby.—There has been some disease followed by fatal results among horses and cattle the past year, but swine have been healthy. A great many fowls have also died.

Tama.—Horses, cattle, sheep, and fowls are in good health and condition. Hogs are dying to an alarming extent throughout the county with both quinsy and cholera. These diseases broke out about six weeks ago.

Washington.—There is no disease prevailing among farm animals in this county. Even the hog cholera has disappeared. Perhaps this is owing to a very poor crop of corn.

Woodbury.—Horses are healthy. A few cattle die annually of black-leg. Hogs are comparatively healthy. Now and then a farmer loses his pigs, and a few grown hogs die of cholera. Chicken cholera is quite prevalent.

KANSAS.

Allen.—Stock has generally been healthy in this county. I know of some 5 head of fine steers, worth \$300, that died of Texas fever. A few cattle were also reported to have died after being turned into stock fields. I think they died for want of sufficient water.

Barbour.—The horses in this county are Texas animals, and die principally from eating *Loco*, a poisonous weed. They also die of itch and other skin diseases. A great many cattle have died; perhaps the value of those lost in the county will aggregate \$20,000. They have to get their living on the range, and during a severe winter many die from exposure. The same may be said of sheep, of which there is a large number in this county.

Barton.—Stock is in good health and condition in this county. Occasionally an animal is lost by accident, but one seldom dies of disease.

Brown.—The county assessors make the following returns as to the value of animals lost in this county the past year from all causes, viz: Horses, \$9,900; cattle, \$8,280; hogs, \$10,995; sheep, \$345; mules, \$1,125.

Butler.—This county contains a large number of cattle, hogs, and sheep, but they have been measurably free from disease during the year. Perhaps 50 head of cattle would cover all the loss worthy of recording.

Cherokee.—Texas fever prevailed to a limited extent among some herds of cattle in this county, but the value of the animals lost by the disease would not exceed \$2,000. All classes of animals are in good health, and the losses have been comparatively small.

Coffey.—With the exception of an outbreak of Texas fever among cattle in the southeastern portion of this county, all classes of domestic animals have been free from contagious diseases during the past year. The mortality among cattle reached between 3,000 and 4,000 head.

Crawford.—So far as I am able to learn, all kinds of farm animals are healthy and doing well. Grain and grass are both abundant. Some fowls have died with rouse and cholera.

Decatur.—Pink-eye is the prevailing disease among horses, and black-leg among cattle. A great many sheep have died from disease and other causes.

Dickinson.—The value of the losses of domestic animals the past year in this county from all causes aggregate as follows: Horses, \$15,675; cattle, \$9,860; hogs, \$5,170; sheep, \$547.

Doniphan.—In the early part of the season quite a number of cattle died. The cause in most cases was the result of turning the animals into corn-fields from green pastures, or into yards where they were fed on husks. So far as I have been able to learn, about 100 head died, mostly feeding steers.

Ellis.—A great many of our horses and mules have been attacked with gleet or farcy, so called by many, and by others pronounced glanders. They have invariably died where not killed. A great many deaths have occurred among calves and yearlings from black-leg. As a preventive we give salt, sulphur, saltpeter, and copperas in the proportion of 1 bushel salt, 4 pounds sulphur, $\frac{1}{2}$ pound saltpeter, and 1 pound copperas; mix thoroughly, and place in troughs where the animals can have free access to it. Some scab exists among sheep.

Elk.—The aggregate value of farm animals lost in this county during the past year is given as follows: Horses, \$8,440; cattle, \$9,360; hogs, \$14,183; sheep, \$1,378. Seventy-eight sheep were killed by dogs.

Greenwood.—I estimate the value of the losses among domestic animals in this county for the past year from all causes as follows: Horses, \$10,000; cattle, \$10,000; hogs, \$8,000; sheep, \$1,250.

Harper.—Our losses among cattle from Texas fever alone has been at least \$15,000. My own opinion is that the estimate is too low. Parties naturally hesitate to admit their full losses. Black-leg among young stock has caused considerable loss. Over one-half of the sheep of the county are affected with scab. The number in the county is perhaps over 30,000. Nearly every flock owner dips his sheep thoroughly after shearing, yet many flocks are again infected by introducing diseased bucks among them. Have not heard of a sick hog in the county the past season.

Harvey.—Stock of all kinds doing well at present. Cattle have died from exposure and accidents, and some calves of black-leg. A few hogs have died of the usual diseases, and some pigs from exposure. A few lambs have also died from exposure, and a great many sheep of scab.

Johnson.—The various diseases affecting farm animals are hard to determine, but the value of the losses in this county may be stated as follows: Horses, \$7,840; cattle, \$16,500; hogs, \$3,900; sheep, \$107.

Labette.—I find it difficult to determine the value of animals lost by disease during the year, but I think the following a very fair estimate, viz: Horses, \$16,200; cattle, \$9,540; hogs, \$9,848; sheep, \$630.

Lane.—The principal disease that prevailed among our cattle the past season was Texas fever. It appeared late in the season, and was caused by driving Texas cattle through the county. Scab is prevailing to a considerable extent among sheep, of which a good many die. Sheep and cattle raising is the principal industry of this county.

Lincoln.—Some horses have died of distemper or pink-eye, and a good many young cattle of black-leg. Some older animals have died of dry murrain. A report recently received from the northwestern section of the county states that a great many cattle have died there within the past few days of an unknown disease. A disease confined to young pigs in the central part of the county has been quite fatal. I lost 27 in two days, and another man 15 in the same length of time. Some called the disease quinsy, but I don't think it was.

Meade.—About 500 horses and mules died in this county the past year of pink-eye, and perhaps 900 head of cattle by disease, old age, accident, &c. There are about 100,000 sheep in the county, of which 25 per cent. generally die of scab.

Montgomery.—No epidemic has prevailed among any class of animals in this county, and the following losses have been caused by the ordinary maladies to which domestic animals are subject, viz: Horses, \$15,500; cattle, \$15,000; hogs, \$12,000; sheep, \$6,500. Chicken cholera has prevailed to an alarming extent in some localities.

Neosho.—No epidemic disease has prevailed among our horses. Calves and yearlings have been afflicted to some extent with anthrax, or black-leg. There seems to be no remedy for this disease. About all those that are attacked die, and are generally dead before they are known to be sick. A great many pigs under six months old have died. Old and fat hogs are seldom attacked by disease. Fowl cholera prevails to a considerable extent.

Osborne.—Horses have been exempt from any special epidemic. Black-leg has prevailed and proved quite fatal to cattle in some localities. There has been no epidemic among hogs. Scab among sheep prevails, but not to as great an extent as formerly. Black-leg among cattle is the chief dread among stockmen and farmers.

Ottawa.—I hear of a flock of Mexican or grade Merino sheep, composed of about 900 head, all of which are afflicted with scab. No other class of animals in this county seems to be afflicted with contagious diseases.

Pawnee.—The only contagious disease I have to record occurred during the past season among a herd of cattle in this county. The disease was Texas or Southern fever. The animals were placed in charge of a veterinary surgeon, who promptly quarantined the herd and prevented the spread of the disease.

Phillips.—Pneumonia or lung fever has caused the death of a few horses in this county. The disease known as black-leg has proved very fatal to cattle. Animals one year old and younger suffer most. At least one-half of those attacked die. The only disease affecting sheep is scab. Great complaint prevails as to the disease known as cholera among chickens.

Rawlins.—There have been a few cases of Texas itch among horses, a disease which is very effectively treated with mercurial ointment. There have been a few cases of black-leg among cattle, and one case of murrain. The opinion prevails among the owners of cattle that the Texas trail brings fever with it, as the losses generally occur within the near vicinity of this trail. Cattle along the trail are infested with lice, or ticks, as they are termed by some. But they look like common lice, with the exception of being larger and having gray heads. Sheep are afflicted with the scab, and are treated by dipping in tobacco wash.

Reno.—Glanders is getting pretty well distributed over this county, and many horses die every year of it. Some cholera prevails among hogs. More care is being taken of stock than formerly. Farmers are beginning to learn that more feed and better shelter, with less loss, is the better way.

Roos.—No disease of a contagious character among horses. Black-leg is about the only fatal disease among cattle. Hogs suffer more in hot weather than during the colder season. A few cases of quinsy have occurred among pigs.

Washington.—Some horses have died of catarrhal and lung fever. Cattle have suffered to a considerable extent with black-leg, and hogs with quinsy and catarrhal troubles. The great loss among pigs was caused by the sows having suffered with these diseases. The young animals had not vitality enough to live.

Wyandotte.—The only disease of a contagious character prevailing among any class of farm animals is scab among sheep. The disease known as cholera still prevails among fowls.

KENTUCKY.

Allen.—There have been a few cases of cholera among hogs in some localities, and some chicken cholera, but the losses have been light.

Breckinridge.—With the exception of cholera among hogs, there has been no disease of consequence prevalent among any class of animals in the county. The cholera has been very fatal to hogs, but as yet the disease is confined to one locality.

Boyle.—Pink-eye has been quite prevalent, and several fine horses and mares have died from the effects of the disease. Hog cholera and Texas fever of cattle destroyed a good many of our animals in 1882, but the diseases have not made their appearance this year.

Calloway.—No disease among horses or cattle. Hogs are dying at a rapid rate in one locality in this county. The disease does not seem to be like the cholera in all respects. The animals droop, refuse to eat, have very sore nose, the belly is tucked up, and the excrement hard. They die in from 3 to 10 days. About 70 per cent. die. The value of the loss up to this time is \$17,860.

Carter.—Horses and cattle are healthy. A considerable number of hogs died in 1882, and also in this year, but I am unable to give the number or value of the losses. Cholera is quite prevalent among fowls.

Clinton.—With the exception of a severe type of epizootic distemper among horses all classes of farm animals are free from disease. I have heard of no deaths from the disease.

Crittenden.—Cattle have died of hollow-horn, hogs of cholera, sheep of rot, and chickens of cholera. The losses have not been very heavy in either class.

Cumberland.—Hogs valued at \$3,000 have died of thumps in this county the past year. The greatest fatality has been among young hogs. Chicken cholera has prevailed all over the county, and has been quite serious in some localities.

Fayette.—Some horses, cattle, and sheep have died from accidental causes, but there has been no epidemic among either class of these animals. Hogs and fowls have died to some extent from cholera, but the disease is certainly less prevalent than a few years ago.

Grayson.—No fatal diseases have prevailed among horses, cattle, or sheep. Great fatality has been caused among pigs in some localities by a disease known as measles.

Green.—Cattle and sheep suffer from the various diseases to which such animals are incident. Hogs and poultry suffer principally from the disease known as cholera. Hogs valued at \$10,920 have been lost during the year, and chickens valued at perhaps \$1,152.

Greenup.—Comparatively little disease among farm stock in this county.

Hancock.—No disease among farm animals at present, though at this season of the year such disorders generally appear.

Harlan.—All kinds of farm animals have been comparatively healthy for the past year.

Hopkins.—All kinds of animals and fowls have been exceedingly healthy the past year. I think this is due in a great measure to the observance of the advice given by the veterinary surgeons appointed by the Government to investigate the diseases of animals. I have largely distributed these reports, and have been greatly benefited myself by the information they contain. I have not lost a hog by cholera since reading these reports.

Jessamine.—Some hog cholera has prevailed in this county, but there has been no disease among other classes of animals the past year.

Johnson.—In the spring cattle in this section are subject to murrain, which generally proves fatal. Hog cholera is very troublesome to farmers and hog-raisers at all seasons of the year. Sheep are affected with rot to some extent.

Kenton.—A great many cattle die every season of dry murrain. There have been some losses by hog cholera.

Knox.—Hogs died throughout this county the past year of cholera. Other farm animals have generally been healthy.

Laurence.—Farm animals have been unusually healthy the past year. Cholera has prevailed to some extent among fowls, but it is impossible to give the number that have died.

Letcher.—No disease of consequence has prevailed among farm animals in this county. A few hogs and fowls have died of the so-called cholera.

Lewis.—In some localities whole herds of hogs have been swept away by cholera. There have been some losses among other classes of animals, but they have not been heavy.

Lincoln.—I presume that 10 per cent. of all our hogs annually die of cholera. Great numbers of fowls also die annually of a like disease.

Madison.—An occasional case of pink-eye among horses is reported. Cholera prevails among swine and poultry. When cholera attacks hogs (and it has been more prevalent than usual), it affects most of the herds, and 50 per cent. or more die.

Martin.—Hog cholera is the most destructive stock disease known here. Other classes of animals are healthy.

McLean.—The loss of hogs in this county has not been so great the past year as usual. Just now I hear of no complaint. The disease did its work during the months of July and August. A few cases of pink-eye have occurred among horses.

Menifee.—The disease prevailing among hogs here seems to be unknown. Some call it cholera and others pronounce it sore throat, caused by the faulty mast.

Mercer.—A large number of all classes of farm animals have been lost by the various diseases to which they are subject during the past year. I will state that more sheep were killed by dogs than were lost by disease.

Monroe.—No epidemic among either horses, cattle, or sheep. Hog cholera prevails in some localities in the county, as does also chicken cholera.

Montgomery.—No disease of any kind among domestic animals or fowls in this county the past year or in 1882.

Muhlenburg.—After consultation with farmers in different parts of the county, I find that all classes of farm animals are in a healthy condition. No disease in 1882.

Nicholas.—Horses and cattle are healthy. Some little cholera among hogs, but not much, say 2 per cent. of disease, of which 1 per cent. die. Cholera prevails to some extent among fowls.

Owen.—We have no disease among our farm stock worthy of note.

Owsley.—No disease among stock. Something like cholera or roupe prevails among fowls. About all that are attacked by the disease die. No remedy appears to do any good. The fowls frequently drop off the roost dead.

Pike.—Horses are afflicted with distemper, bots, and colic, cattle with murrain, quinsy, and sore throat, hogs with quinsy and occasionally cholera, and fowls with cholera.

Robertson.—I have no general or fatal disease to report as affecting farm animals in this county.

Rock Castle.—No prevailing disease among horses, cattle, or sheep. Some hog cholera prevails; perhaps 2 per cent. of the animals in the county have been attacked.

Russell.—Hogs have been affected in a few localities by swine-plague. A like disease has been more general among fowls.

Scott.—We have no prevailing disease among our farm animals except cholera among hogs. Fowls are also afflicted with a similar disease.

Shelby.—Hogs valued at between \$7,000 and \$8,000 have been lost by cholera during the year. A number of fowls have died of the same disease.

Taylor.—We have no losses to report among our farm stock by disease of a contagious character.

Trimble.—Our county is unusually healthy for farm animals. Never any disease among any class except an occasional case of hog cholera.

Union.—Horses and cattle have been unusually healthy. A great loss has been occasioned by hog cholera. More animals have been affected with the disease, and it is thought that more died, this summer than during the six years preceding. The value of the losses may be set down at \$50,000 or \$60,000. No remedy has been found for the disease. A few sheep have died of rot.

Washington.—Horses and mules have suffered from pink-eye. Cattle have been visited by an unknown epidemic. Cholera has been more fatal to hogs than usual. Sheep have suffered from various causes and ailments.

Whitley.—The only loss among farm animals in this county has been among hogs. I think \$10,000 would cover the value of these losses. The disease affecting both hogs and fowls is known here as cholera.

LOUISIANA.

Bienville.—None but ordinary and common diseases have affected farm stock in this county the past year.

Bossier.—Horses, mules, cattle, sheep, and hogs have been extremely healthy this fall, and all are doing well.

Catahoula.—Value of horses lost the past year, \$2,334.50; value of cattle lost, \$3,727.50. Hogs have continued very healthy. A few sheep have died of pleurisy and pneumonia.

Franklin.—Horses have been afflicted with glanders, staggers, charbon, and big-head; cattle with charbon, big-head, and hollow-horn; hogs with staggers, and sheep with rot.

Iberville.—All kinds of farm animals have been healthy during the year. There has been some fowl cholera.

Jackson.—Less disease among horses this year than for twenty-five years past. Cholera and mange have been fatal to a great many hogs. Cholera has also been destructive to fowls.

La Fourche.—No epidemic disease has prevailed among any class of our animals the past year.

Livingston.—The following are perhaps correct estimates of the value of farm animals lost in this county the past year, viz: Horses, \$170; cattle, \$1,500; hogs, \$2,000; sheep, \$750.

Madison.—We have but few hogs, and no malady among them. We have a great many fowls and plenty of chicken cholera.

Morehouse.—All kinds of animals are healthy. Our soil is destitute of gravel, and we have to grind up old crockery, &c., for our fowls. When this is neglected cholera appears among them and kills from 10 to 20 per cent. of the whole number.

Richland.—Much stock was lost by the overflow in this county, and many cattle were afterward forwarded to Texas, so that we have but few of this class of animals left. No disease of consequence.

Saint Helena.—During October and November a disease prevailed among our hogs which was said to be cholera. In the higher piney woods portion of the parish the disease killed many hogs—as near as I have been able to learn, full 50 per cent.

Saint Mary's.—We have but little stock in this county, and what we have is in a remarkably healthy condition.

Saint Tammany.—None but common diseases have visited any class of farm animals the past year, and the losses have been very light.

Vernon.—With the exception of sheep, all classes of domestic animals have remained healthy.

West Carroll.—We have lost quite a number of all classes of farm animals during the year by disease. The diseases, however, have not been of a contagious character.

MAINE.

Androscoggin.—Horses, cattle, hogs, and sheep are in about the same condition as to health as last year.

Cumberland.—Domestic animals have been very free from epidemic diseases. Pink-eye has prevailed to some extent among horses, but no cases have proved fatal. An unknown disease prevailed among horses to some extent last fall, of which several died. Some attributed it to poison, and others thought it a congestive fever. The horse would be suddenly attacked, lose the use of his hind legs, as well as all power to swallow. If on the road, in harness, would fall without warning, never to rise again.

Franklin.—An occasional case of pink-eye has been reported among our horses, but no deaths have occurred from it. No other diseases among farm animals.

Kennebec.—Pink-eye and epizooty in a mild form have prevailed among horses. Cattle, hogs, and sheep are healthy.

Oxford.—All kinds of domestic animals are reported healthy in this county.

Penobscot.—All kinds of farm animals are healthy. There has been no special disease among our cattle during the past twenty years.

Somerset.—Horses are reported to have had lung troubles. Some cows coming in have been sick. Sheep have had the foot-rot, but the percentage of loss to the whole number has been exceedingly small. There have been no epidemic or contagious diseases.

Washington.—With the exception of pink-eye among horses, with no fatal results, I can hear of the prevalence of no disease among the farm stock of this county.

York.—The domestic animals of this county have been free from all kinds of epidemic diseases during the past year.

MARYLAND.

Anne Arundel.—There has been no epidemic among farm stock in any part of the county, and losses have only been such as usually occur from accident or to such acute attacks as animals are sometimes subject.

Baltimore.—My district has been afflicted by a disease among fattening hogs, which spread to others in this and adjoining districts. I myself lost all but one sow, some 20 head, and my neighbors on each side of me for a mile lost all they had. The disease was so rapid in its results (death) that we were not able to make much use of remedies, or take steps to prevent its spread. The symptoms were so different, or were described so differently, that I am unable to give an account that would cover any but my own cases, although I am sure that what caused my loss was the same as that which caused the loss of my neighbors. My pigs commenced to mope; refused food; jaws seemed to lock; some had cough, and were dead in a day or two, except in one or two instances in which they limped and broke out into sores all over the body. The first one attacked recovered, which she did without having been given anything in the shape of medicine. The neighbors doctored and gave medicine, but lost their animals just as I did. I could not bring myself to use all the remedies recommended, because I could not tell just what ailed the hogs, and preferred to trust to nature and good food and nursing, rather than be doubtful after whether I or the disease killed them. I know the loss must have been much heavier than I have represented (\$2,500), as I have just learned from one coming in of additional cases in various localities, enough to raise my estimate \$500.

Calvert.—This has been an unusually healthy year for all kinds of farm animals in this county. There have been no deaths that I can hear of except such as are incident to accident and old age.

Frederick.—There has been no epidemic disease among either horses, cattle, hogs, sheep, or fowls; hence the losses have been occasioned by accident or old age.

Garrett.—I do not hear of the prevalence of any disease among horses, cattle, or sheep. Hog cholera prevails to some extent, but not so generally as last year.

Howard.—We take good care of our stock by stabling and sheltering, as a rule; hence we rarely have destructive diseases among our farm animals.

Prince George's.—I have heard of no epidemic among farm animals of any kind in our county. A neighbor of mine bought a yoke of young oxen, large, fine animals, which cost him \$100; a month or so ago they were taken with weakness across the loins, and could not raise upon their hind legs or feet. They lingered for three weeks and both died. The State veterinarian pronounced the disease Texas fever.

Somerset.—In some parts of the county the swine plague is now prevailing quite seriously, but the area over which the disease extends is not large. I have heard of no disease among fowls this year.

Talbot.—We have no disease among stock or poultry. Occasionally a few hogs die, but the cause can generally be traced to drinking impure water or eating poisonous matter. All animals are in remarkably good health at this time.

Washington.—The value of the losses among farm animals in this county the past year may be estimated as follows: Horses, \$4,000; cattle, \$2,500; hogs, \$1,200; sheep, \$600; and fowls, \$150.

Worcester.—During the current year there have been no prevailing diseases among any class of farm animals, and the sporadic cases of sickness and death have been so rare and scattered as to render it impossible to give reliable data.

MASSACHUSETTS.

Berkshire.—Few horses have died from the disease known as pink-eye. Hogs have suffered to a considerable extent from cholera. I should think \$2,000 worth have been lost by the disease. Cattle, sheep, and fowls are in comparative good health.

Dukes.—No epidemic disease has prevailed among domestic animals in this county the current year.

Franklin.—Among horses, cattle, and hogs in this county the losses have not been over 1 per cent. by disease the past year. There has, perhaps, been a loss of 3 per cent. among sheep.

Plymouth.—An animal very rarely dies of disease in this county. Much of this is due to the kind provision made for all kinds of domestic animals.

MICHIGAN.

Allegan.—Our farm animals are rarely attacked by fatal diseases. Occasionally a horse contracts cold which settles on his lungs and he dies. Cattle, hogs, and sheep are healthy.

Benzie.—No diseases of an epidemic or contagious character seem to have visited the farm stock of this county the past year.

Calhoun.—Horses have suffered from a mild type of pink-eye, which has seldom proved fatal. Several deaths have occurred from colic, inflammation of the lungs, and other diseases common to horses. There has been no epidemic among hogs, cattle, or sheep during the year.

Cass.—There have been several fatal cases of pink-eye among the horses in this county. It seems to have prevailed throughout the county. Milk fever has been the most destructive disease that has prevailed among cattle. There have been some lung troubles, but no cholera, among hogs. Some loss of sheep from diseases in the head, but more from lung affections caused by colds.

Charlevoix.—I have heard of the prevalence of no disease of any kind among the stock in this county the current year.

Clare.—So far as I can learn, there seems to have been no disease of consequence among farm animals in this county during the year.

Crawford.—Eight horses have died during the year with what was supposed to be pink-eye. No other domestic animals have suffered to any extent.

Delta.—I can hear of no disease of a contagious nature prevailing among any class of farm animals in this county.

Genesee.—No epidemic diseases have prevailed among stock in this county. The following is perhaps a fair estimate of the losses among all classes of animals for the year, the result of disease, old age, accident, &c., viz: Horses, \$3,500; cattle, \$1,250; hogs, \$1,125; sheep, \$1,875; fowls, \$1,000.

Gladwin.—No destructive disease of any character has visited any class of domestic animals in this county the past year.

Huron.—No epidemic has visited either our horses, cattle, sheep, or hogs during the past year. I have not even heard of a case of glanders.

Ingham.—The following is probably a fair estimate of the value of the losses among farm animals in this county for the current year: Horses, \$14,700; cattle, \$7,000; hogs, \$2,250; sheep, \$1,660; and fowls, \$1,000.

Ionia.—We have had no disease of consequence that I can hear of among either horses, cattle, hogs, or sheep during the year.

Jackson.—There has been no disease of any kind among animals in this county, and the deaths have only been those arising from natural causes, and have been rather under than over the usual annual average.

Kalamazoo.—No contagious or epidemic disease among animals in this county.

Lapeer.—Farm animals go into winter quarters in first-rate condition. No disease of a general character prevalent.

Leelanaw.—All kinds of farm animals are very healthy. Horses have suffered to some extent from epizooty, and a few cattle have died of dry murrain. A few sheep have died of pneumonia.

Livingston.—It seems impossible to get the information you desire. However, there has been no destructive disease of any kind among our domestic animals during the past year.

Macomb.—A good many young horses annually die in this county. There has been no disease among cattle and hogs. Sheep seldom recover when attacked by disease. Many fowls die of cholera. Some farmers have lost their entire flocks by the disease.

Manitou.—No disease worthy of mention among farm stock. A great many fowls have been lost by disease.

Marquette.—The only disease among horses is a swelling of the hind legs. They do not die of it, but when they get very bad they are shot, as the swelling gets so large they become useless. I have no other diseases to report.

Mecosta.—I can safely say that there has been no epidemic among any class of farm animals in this county during the present year.

Oceana.—There has been no epidemic disease among the farm animals of this county during the past season.

Oscola.—No diseases among farm stock in this county.

Oscoda.—Very few animals in this county, and, of course, but little disease. I do not know of a sheep in the county.

Ottawa.—But few farm animals are ever affected with disease in this county, and only those that are improperly treated or exposed to inclement weather.

Presque Isle.—I have no case of disease or death from contagious diseases among farm stock to report for this county.

Saginaw.—All kinds of domestic animals—horses, cattle, hogs, and sheep—in this county are in a very healthy condition.

Saint Joseph.—I am unable to get accurate information in regard to losses of farm animals in this county, but I am satisfied they are very small.

Tuscola.—The only losses that have occurred among our farm animals have been caused by old age, accident, &c.

Van Buren.—No prevailing disease among animals in this county that I know of, except among breeding sows. Cannot say how many animals have died; perhaps thirty head in the county.

Washtenaw.—Horses, cattle, sheep, and hogs are all free from contagious and infectious diseases. Stock of every kind in this county is in good condition.

Wayne.—I do not know of the loss of any stock in this county the past year, except from natural causes.

MINNESOTA.

Becker.—As far as I can learn, the farm animals of this county have been quite free from disease the past year. In cases where distemper, lung fever, and influenza have occurred they have generally been caused either by the carelessness of exposing animals to sudden changes of temperature from a heated state to a cold or chilled one, or from being confined in damp stables.

Big Stone.—There are no diseases prevailing among farm stock here. A few horses have been killed by overwork.

Blue Earth.—Animals of all kinds are free from disease.

Brown.—A few farm animals have been lost in this county by disease, more cattle perhaps than animals of any other class.

Carver.—There has been no mortality from disease among farm animals in this county for the past ten years. Fowls are afflicted with cholera.

Chisago.—No disease of any kind is afflicting our stock, for which we are duly thankful.

Chippewa.—There has been no disease among horses, hogs, or sheep. Some few cattle have died of black-leg, but not so many as in former years.

Dakota.—No disease among our domestic animals.

Dodge.—There have been a few deaths among horses from pink-eye, and from black-leg among cattle. A few hogs have died. During the past twenty-eight years the farm animals of this county have not suffered from any fatal epidemic disease.

Fillmore.—There have been some losses of young cattle from the disease known as black-leg. A few hogs have died of a disease pronounced cholera, but I have not seen a case of real hog cholera in the county. There have been losses among fowls, but no more than usual.

Houston.—Pink-eye has prevailed to some extent among horses, but it has not often been fatal. No disease this year among cattle or hogs. Fowl cholera has prevailed to a limited extent. This disease seems to be disappearing.

Jackson.—No contagious or infectious disease is prevailing among any class of domestic animals or fowls. A few young cattle died during the season from black-leg.

Kanabec.—I have no losses worth recording among the farm animals of this county for the past year.

Lac-Qui-Parle.—Stock of all kinds perfectly healthy. Few animals die except from old age or mismanagement in feeding and watering.

Lake.—There are but few domestic animals of any kind in this county. The only losses that occur are among draught horses, caused by overwork, carelessness, &c.

Le Sueur.—A few cases of epizooty have occurred among horses. Cattle, hogs, and sheep are in good health and condition.

Lowndes.—The losses caused by disease among the farm animals of this county the past year are very small. No epidemic disease has prevailed.

McLeod.—A few cases of pink-eye have occurred among horses, and black-leg has prevailed to some extent among cattle. Young animals of the age of one and two years have suffered most. It would be a great advantage to stock-raisers if the cause and a remedy for this disease could be discovered. During some seasons a great many young cattle die of it.

Martin.—There has been no disease among stock in this county this year—that is, not sufficient to be worthy of note. Some cattle have died of black-leg.

Meeker.—As far as I can learn—and I have had good facilities for obtaining information—there has been no loss of stock from disease worthy of mention during the year.

Morrison.—But very few farm animals have died of disease during the past year. No epidemic of any kind has prevailed among stock.

Nicollet.—No destructive disease to record among any class of farm animals in this county.

Nobles.—Farm animals of every class have always been very healthy. The value of the losses for the past year are therefore not worth recording.

Norman.—No epidemic disease has prevailed among any class of our farm stock the past year. The only losses that have occurred were caused by want of proper care in feeding and watering animals.

Olmsted.—Diseases among farm animals are so rare, and the fatality so small, that the losses are not considered worthy of recording.

Pinc.—After careful inquiry I cannot learn that there has been any particular disease prevalent among the domestic animals of this county during the current year. This is not a stock-raising county in any sense.

Pope.—Pink-eye has prevailed more or less among horses. One man lost six animals. Cattle have been affected with black-leg, and hogs with cholera. Some cases of rot have occurred among sheep.

Redwood.—The past year has been a very favorable one for farm animals. I cannot learn of a sufficient number of losses to make a basis for any sort of a report.

Rice.—No epidemic diseases have been noted among farm animals the past year. Fowls have been diseased, and the losses have been quite heavy. Considerable interest is being manifested in the raising of improved breeds, especially horses of larger types. An interest is also being awakened in the dairy industry, for which this county seems well adapted.

Scott.—The only losses that have occurred among farm animals in this county the past year have been the result of natural causes, accidents, &c.

Sherburne.—Occasionally a horse dies from old age, a cow from milk fever, and a calf from scouring. The loss will not amount to 1 per cent. per annum to any class of animals.

Sibley.—Pink-eye has prevailed among horses and black-leg among cattle. I presume cattle worth \$1,000 have died during the year of the latter disease.

Stearns.—Nothing but the usual horse distemper has appeared among any class of our farm stock during the past year.

Steele.—No epidemic among farm animals the past year. Losses among all classes have been confined to very young or very old animals, thus greatly reducing the average value of those lost.

Stevens.—I have no losses among farm animals from disease of sufficient magnitude to report.

Traverse.—There has been no disease among our stock which has assumed an epidemic form. A few animals have died of disease, but the percentage has been small.

Watsonwan.—No disease among horses. Occasionally one dies from abuse, old age, or natural cause. The only disease among cattle has been an occasional case of black-leg. Young calves suffer most. One per cent. will cover the losses from this disease. There has been no disease among hogs or sheep.

Winona.—All classes of farm animals have remained free from contagious or epidemic diseases during the past year.

Wright.—There has been no special disease among our farm animals during the year. A great many sheep have been killed by dogs and wolves. Many farmers have been compelled to give up trying to rear this class of stock.

MISSISSIPPI.

Alcorn.—Very few deaths have occurred among farm animals in this county from disease. The losses among each class have been small, and generally from natural causes.

Amite.—Among horses, mules, and cattle we have had no prevailing disease this year nor the year previous worth mentioning. Hogs, sheep, and fowls suffered to some extent early in the spring, during the wet season.

Benton.—There has been very little disease of an epidemic character among our farm animals the past year; hence our losses have been small.

Cathoun.—No disease among farm stock the past year.

Carroll.—No epidemic has prevailed among the farm stock of this county, and the losses for the past year have been nominal.

Choctaw.—The farm animals of this county have been measurably free from disease the past year. There have been a few cases of charbon among cattle and cholera among hogs.

Copiah.—There has been no disease among our farm animals. Chicken cholera has been widespread and destructive. Many persons have lost almost their entire flocks.

Covington.—The only disease of consequence that has visited our farm animals is that of cholera, which has prevailed to some extent among hogs. The losses have been light.

Greene.—The only loss of farm animals in this county has been among sheep. A great many of these animals have been destroyed by dogs, in addition to those which have died of disease.

Harrison.—No losses from disease among our farm stock for the past year.

Hinds.—No serious disease has occurred among any class of our farm animals. A number of cattle died during the winter from exposure to inclement weather. Some winters our losses are very heavy for lack of adequate protection to stock.

Jasper.—There has been some distemper among horses. Hogs have suffered with cholera, and sheep with a disease called sore-head.

Marshall.—Horses have died of blind-staggers, pink-eye, and colic, but the majority of poverty. Cattle have died of murrain, and a great many also of poverty. Hogs worth, perhaps, \$7,000 or \$8,000 have died of a disease denominated swine fever or hog cholera. Sheep are afflicted with rot. Large numbers of fowls have died of cholera, as described by veterinary reports.

Newton.—There has been no epidemic of any kind among our farm animals during the year. Even fowl cholera has not been so troublesome as formerly.

Oktibbeha.—Some little cholera has prevailed among hogs, and occasionally there has been a case of blind-staggers among horses, but nothing like an epidemic has occurred among any class.

Simpson.—Cholera has swept off about one-half the hogs in this county; value, over \$12,000. A new disease prevailed among cattle, which destroyed a great many head. They lived only about twenty-four hours after being attacked.

Tippah.—There have been no losses from disease among the farm animals of this county worthy of reporting.

Tishomingo.—The past year has been a very favorable one for farm animals in this county. No disease of consequence has visited any class.

Union.—Hog cholera has prevailed in the northeast corner of the county, but it has not been very destructive.

Warren.—Texas fever has prevailed among our cattle. All those attacked died. Nine of my own cattle died within three days. Native cattle were not affected—only the imported animals seemed to be susceptible. Sheep are afflicted with flukes. Those afflicted with this disease will all die if not physicked.

Wayne.—Distemper has occurred among both horses and sheep, murrain among cattle, and cholera among hogs and fowls.

Winston.—Some fifteen or sixteen horses have died this year from distemper. No other disease of a destructive character has prevailed among stock.

MISSOURI.

Adair.—No disease of a destructive nature has occurred among farm animals or fowls in this county during the year.

Barry.—Distemper has prevailed to some extent among horses, and a few cases have proved fatal. About 20 per cent. of our hogs have been affected with cholera and about 10 per cent. of those affected have died. Cholera also prevails among fowls.

Bollinger.—No destructive diseases have visited any class of our farm animals during the past year. They are healthy without exception.

Caldwell.—During the past year the losses caused by disease among farm animals in this county have been comparatively small. No disease of a very malignant character has prevailed.

Carter.—All four classes of farm animals have been exceedingly healthy throughout this county the past year.

Cedar.—A few cases of distemper and glanders have occurred among horses. Cholera prevails among hogs, and about half the number attacked die. Dogs destroy a great many sheep. Cholera prevails to a wide extent among fowls, and about all that are attacked die.

Crawford.—We have had no fatal diseases among our stock the present year.

Dallas.—The deaths from disease among our farm animals have been so few that I am unable to even approximate the value of the losses.

Davies.—There has been no destructive disease among our domestic animals. Cholera has prevailed to some extent among fowls.

Dent.—I have heard of no losses among farm animals during the present year.

Douglas.—Our horses are healthy. Black-leg has occurred among cattle, and hogs have been afflicted with cholera.

Franklin.—The principal cause of disease among our horses is over-feeding with corn or oats, and then too much water and over-driving. In winter cattle are lost from neglect, both as to feed, water, and shelter. Hogs are lost by improper shelter and too much corn—in other words, a lack of a sufficient variety of food and clear water to drink.

Gasconade.—No diseases of a fatal character have prevailed among any class of farm animals.

Greene.—So far as I can learn, there is no prevailing disease among domestic animals. We occasionally have an epidemic among hogs and poultry, but just now not any.

Harrison.—Farm animals in this county the past year have been unusually healthy. No epidemic disease has appeared among them.

Hickory.—We have had no hog cholera in this county since 1875-'76.

Holt.—No epidemics exist among domestic animals in this county. The diseases that usually affect horses and mules are the result of hard usage. The losses from various causes may be stated thus: 150 horses, \$7,500; 50 cattle, \$1,500; 500 hogs, \$1,000; 30 mules and asses, \$2,250.

Jefferson.—But few diseases of a fatal character have visited our farm animals the past year. The value of the losses may be thus given: Horses, \$2,000; cattle, \$10,200; hogs, \$300; sheep, \$200.

Johnson.—In the northeastern part of the county considerable cholera prevails among pigs and small shoates. Fully three-fourths of those attacked die. As a rule, farm animals are healthy in this county.

Laclede.—We have no disease to amount to anything among either horses, cattle, hogs, sheep, or fowls. A very limited number of cases of hog cholera have occurred.

Lawrence.—Several cases of Texas fever occurred among cattle in this county last summer. Hog cholera prevails to a considerable extent, but I cannot give the value of the losses.

Lincoln.—We have had no contagious disease among horses or cattle. Cholera has

prevailed among both hogs and chickens, and rot and scab among sheep. The value of the losses among swine has been about \$24,000; among sheep, \$6,250; and fowls, \$2,000 or \$3,000.

Linn.—We have had no disease among farm stock in this county the past year to amount to anything.

Livingston.—No disease except among hogs and fowls. Hogs are more healthy than they have been in the past eight years. The losses this year will perhaps foot up \$15,000. The losses among fowls have been quite heavy; the value will perhaps reach \$7,500.

Macon.—There have been but few fatal cases of disease among our farm animals the past year.

Madison.—About 3 per cent. of the hogs of this county have died during the year of disease. Two per cent. of the horses and one per cent. of the cattle have also died.

Miller.—A large number of hogs have died of cholera during the year. Other classes of animals have remained in good health.

Moniteau.—This is not only a remarkably healthy county for all kinds of live stock, but this has been an exceptionally healthy year, so much so that we consider it proper to report no diseases or losses at all.

Monroe.—No fatal disease has prevailed to any considerable extent among the domestic animals and fowls in this county during the past year. A few cases of black-leg among calves and cholera among hogs have occurred. Fowl cholera has also prevailed to a limited extent. This fatal disease among fowls can be controlled or prevented by the use of hyposulphite. We have fully tested it during the past two years. It is a valuable medicine.

New Madrid.—The total value of animals and fowls lost in this county by disease the past year is \$18,641.87. About \$16,000 of this amount is attributable to diseases among hogs. Several cattle died of an unknown disease. The livers of those I examined were rotten.

Newton.—There have been no losses of consequence among our farm animals by disease the past year.

Nodaway.—Distemper of an epizootic character has been quite fatal to horses in this county. Pink-eye and black-leg have visited our cattle, and cholera has been quite prevalent among hogs and fowls. The following estimates of our losses are given: Horses, \$30,000; cattle, \$4,000; hogs, \$20,000; sheep, \$1,500; fowls, \$2,000.

Osage.—No disease of an epidemic character has appeared among any class of farm stock except cholera or swine plague. I suppose hogsto the value of \$5,000 have died of this disease the past year.

Ozark.—There has been no epidemic or fatal disease of any kind among our domestic animals during the year.

Platte.—For the last year or two all kinds of animals in this county have been remarkably healthy. This is no doubt owing to the fact that farmers are taking better care of their stock than in former years.

Pulaski.—Cattle are about the only farm animals that have been afflicted during the past year. The disease known as black-leg has prevailed among them, and a great many calves and yearlings have died.

Putnam.—The following estimates of the value of losses among farm animals from all causes are given for the current year: Horses, \$25,000; cattle, \$62,500; hogs, \$10,000; sheep, \$2,500; and fowls, \$1,000.

Randolph.—The value of animals lost in this county the past year from disease and natural causes is given as follows: Horses, \$3,200; cattle, \$10,000; hogs, \$5,700; sheep, \$4,600, and fowls, \$1,250. When a horse or cow is affected with disease the owners endeavor to cure them, but with hogs, sheep, and fowls nothing is done.

Saint Charles.—Hog cholera has prevailed to some extent, and has proved very fatal to the animals attacked. The value of the losses will reach \$7,000.

Saint Louis.—Have heard of six horses diseased with glanders, of which three died.

Have heard of but one lot of hogs afflicted with disease. They have something like diarrhea or flux. Some fifteen or twenty of them died. Other animals are healthy.

Schuyler.—Cattle have suffered with black-leg and hogs with cholera. Sheep are becoming badly affected with scab. Fowls have been afflicted with the usual disease—cholera.

Shelby.—Farm animals of all kinds are healthy. Fowls die every year of cholera and roupe.

Stoddard.—The only loss I have to record among farm animals in this county has been among hogs. The value of the losses have been small. Will not exceed \$2,000.

Taney.—I can hear of no disease except black-leg among cattle. This has been quite prevalent, and is generally fatal. The value of the losses from this disease will perhaps reach \$4,000.

Vernon.—No fatal epidemic disease has visited any class of our farm animals during the year.

Warren.—The health of all classes of farm animals here was never better than now.

Wayne.—The value of the losses from disease among our farm animals during the past year is estimated as follows: Horses, \$7,500; cattle, \$2,750; hogs, \$2,500; sheep, \$1,300; and fowls, \$225.

NEBRASKA.

Adams.—So far as I have been able to ascertain, no disease of any consequence has prevailed among our farm animals during the past year.

Antelope.—So insignificant have been the losses by disease among domestic animals that I do not deem them worthy of report.

Boone.—Horses, cattle, hogs, and sheep are remarkably healthy—no disease of any kind. A horse dies occasionally of old age or accident.

Cass.—Cattle and hogs are the only classes of animals that have suffered with disease in this county. Cattle have been afflicted with black-leg and hogs with cholera and lung diseases.

Cedar.—The losses among farm animals in this county by disease the present year have been very light.

Dawson.—But few farm animals have been lost by disease in this county during the year.

Douglas.—Five or six horses died during the year of pink-eye. In the fall some cattle died of indigestion, caused by eating corn husks. We have lost some hogs and fowls by cholera, and some sheep have died of scab.

Furnas.—Animals of all kinds have generally been healthy the past year. A few horses have died from change of climate, overwork, &c. In some localities cattle have died of the disease known as black-leg. I have no losses to report among hogs, sheep, or fowls.

Hall.—Black-leg has lately made its appearance among some herds of cattle which have been allowed to feed without restraint upon newly husked corn fields. I believe this to be the principal cause of the disease. No other disease has appeared among farm stock. Chicken cholera prevails in some localities.

Hamilton.—I have heard of but very few cases of disease among farm animals in this county. There has been considerable loss by chicken cholera. Some farmers have lost all—others few.

Johnson.—All farm animals are in good health and condition. No epidemic has occurred during the year.

Kearney.—I have no losses to report from diseases among domestic animals for the past year.

Lancaster.—I can obtain no reliable data as to losses among farm animals in this county for the current year.

Merrick.—Some horses have been lost during the year by diseases incident to them.

Cattle, hogs, and sheep are healthy. Cholera has prevailed to some extent among fowls.

Nemaha.—There is so little disease or loss among farm animals the current year as to hardly be worth mentioning. Some distemper and pink-eye among horses, but no loss. A few cases of "kidney worm" among hogs, which readily yields to treatment, and scab among sheep.

Phelps.—The only loss among farm animals worthy of record has been among sheep. I suppose \$1,000 would cover the value of these losses.

Platte.—No epidemic has appeared among the domestic animals of this county for the current year.

Polk.—No fatal diseases among farm animals. Chicken cholera has been quite prevalent and fatal.

Richardson.—Scarcely any disease among the farm animals of this county. I do not know personally of the death of a horse, cow, or hog during the season, and my location is a central one.

Saunders.—I have been unable to hear of the prevalence of any fatal disease among live stock in this county.

Webster.—With the exception of hog cholera, no other contagious disease seems to have visited any class of our farm animals during this year.

NEVADA.

Esmeralda.—Horses have been afflicted with distemper and lung fever. The latter has proved very fatal to stallions. Black-leg has been quite fatal to calves and yearling cattle. It has been fatal in almost every instance. The symptoms are the swelling of one or more of the legs. Sometimes the swelling is confined to the hip or side of the neck and head. After death the part affected becomes badly bloodshot. No remedy has been found for the malady.

Lyon.—Lung fever has proved fatal to some horses, and black-leg has been very fatal to cattle. Hogs and sheep are healthy.

Nye.—The annual losses of farm animals in this county from disease are trivial.

NEW HAMPSHIRE.

Belknap.—There has been no prevailing disease among animals in this county the current year. Some few animals have died, but I am unable to form any idea of the number or value. It must be, however, a very small percentage of the whole number.

Cheshire.—No epidemic disease among horses, cattle, or hogs. Some foot-rot among sheep and diseases among fowls.

Coos.—No epidemic disease of any nature has prevailed among our farm animals during the year. The losses have been comparatively small.

Hillsborough.—I hear of but few losses of cattle, sheep, or hogs during the past year. No epidemic has occurred among either class of domestic animals.

Sullivan.—The value of the farm animals lost in this county by disease the current year will probably aggregate in the neighborhood of \$5,000, as follows: Horses, \$2,400; cattle, \$1,500; hogs, \$250; sheep, \$700.

NEW JERSEY.

Atlantic.—I have heard of no contagious or epidemic diseases existing among our farm animals. The increase of live stock in this county since 1880 has been at least 15 per cent.

Camden.—All classes of farm animals have been unusually exempt from disease the past year. I cannot hear of a case of contagious disease that has proved fatal. Fowls have suffered with cholera, but this disease yields readily to treatment with sulphur and sulphuric acid.

Cape May.—No diseases exist among farm animals or fowls in this county. Occasion-

ally there is a case of pink-eye among horses, but the disease rarely proves fatal. Some loss among fowls by disease.

Essex.—With one exception there has been no contagion among horses or cattle in this county. The exception was in South Orange, where forty-six horses in the South Orange and Newark horse-car stables suffering with glanders were killed by order of the health officers of the State.

Gloucester.—No disease prevails among any class of domestic animals in this county. Chicken cholera prevails to a more or less extent throughout the county.

Middlesex.—I have no losses from disease to report among the farm animals of this county. There has been a heavy loss among fowls.

Morris.—I have heard of the prevalence of no disease among farm stock for the past year.

Ocean.—I am glad to state that the live stock of our county is remarkably (I might almost say absolutely) free from all contagious diseases.

Salem.—The losses of farm animals by diseases during the past year were very few in this county.

Warren.—I do not think any disease of a contagious character has prevailed among any class of our farm animals during the year.

NEW YORK.

Allegany.—No serious epidemic has occurred among any class of domestic animals in this county during the year. The value of the losses, from all causes, may be stated thus: Horses, \$3,500; cattle, \$1,600; hogs, \$150; sheep, \$250; and fowls, \$1,262.50.

Broome.—I have not been able to hear of the prevalence of any contagious or fatal malady among any class of our farm animals.

Cayuga.—The usual diseases have prevailed among farm stock in this county the past year, though they have been of rather a mild form. Pink-eye and influenza have been the principal diseases. There were 72 cases of pink-eye, of which 13 proved fatal. Out of 32 cases of influenza there were 7 deaths. Cattle and swine are healthy. There were 73 cases of scab among sheep, but no deaths. Of foot-rot there were 160 cases and 32 deaths. There has been a great deal of cholera among fowls. About all that have been attacked have died. The same might be said of rouse. These diseases trouble us a good deal.

Chautauqua.—There has been no epidemic disease among farm stock in this part of the State during the past three years. The following estimates of losses for this county are for diseases of all kinds liable to affect farm stock. The largest share of such casualties may no doubt be charged to improper feed and care or to neglect. The estimates are: Horses, \$1,275; cattle, \$1,100; hogs, \$325; sheep, \$150.

Columbia.—While no epidemic seems to have prevailed among any class of farm stock in this county during the year, the aggregate loss foots up quite a large sum. The losses in detail are given as follows: Horses, \$12,500; cattle, \$8,000; hogs, \$3,750; sheep, \$2,500; and fowls, \$1,125.

Cortland.—No losses from disease are reported as having occurred among the farm animals of this county.

Dutchess.—I am pleased to say that no contagious or infectious diseases have prevailed among our farm animals the past year.

Essex.—There has been some little trouble with pink-eye among horses. Generally, however, farm animals have been very healthy.

Franklin.—None but the common ordinary diseases incident to farm stock have prevailed the past year. This is a good climate for both man and beast.

Fulton.—Horses, cattle, sheep, and hogs have remained healthy during the year. Some disease has prevailed among fowls.

Genesee.—We have very little disease among our farm animals, and what we have are isolated cases. Farmers know that good feeding and proper treatment are better than doctors' nostrums.

Greene.—The value of the losses among farm animals in this county for the year are given as follows: Horses, \$3,125; cattle, \$1,260; hogs, \$700; sheep, \$665; and fowls, \$1,000.

Hamilton.—There have been no epidemics during the past year among our domestic animals or fowls. Last winter was a very severe one on work horses, and several died, probably more from overwork and exposure than from disease.

Herkimer.—We have had no epidemic disease among our domestic animals during the past year, except abortion among dairy cows, and this to a less extent than in former years.

Levis.—I have no losses to report among farm animals in this county. No epidemic has prevailed among any class.

Livingston.—The value of farm animals lost in this county the past year from disease and other causes may be estimated as follows: Horses, \$3,750; cattle, \$1,250; hogs, \$400; sheep, \$105, and fowls, \$70.

Madison.—All kinds of farm animals and fowls have remained free from disease during the year.

Monroe.—This is not a stock-growing county, but among the limited number of animals kept there has been no prevailing disease, and only the usual deaths from common maladies, accidents, &c.

Montgomery.—No epidemic is reported as having prevailed among farm animals in this county, yet a heavy mortality is reported among some classes. The value of the losses is given as follows: Horses, \$3,000; cattle, \$30,000; hogs, \$1,200; sheep, \$240, and fowls, \$562.

Niagara.—There has been no epidemic among any kind of farm animals in this county during the past year, so the comparative loss has been very small, and the result principally of some acute disease or accident.

Oneida.—There has been no disease of a marked nature among any class of our farm stock. This is pre-eminently a dairy county, and the number of cattle varies but little from year to year.

Onondaga.—I have no losses of consequence to report among the farm animals of this county for the year.

Ontario.—No epidemic occurred among any class of farm animals during the year 1882. Fowls were affected in 1882 to about the same extent as during the present year and with the same disease, called chicken cholera.

Oswego.—A great many horses were affected with pink-eye in 1882; perhaps 1,500 were attacked, causing a loss of 150 head. No disease of a contagious character has prevailed among any class of animals this year.

Otsego.—From all the information I have been able to obtain I am led to believe there have been no appreciable losses from epidemic diseases among any branch of farm animals during the year.

Schoharie.—There has been no unusual disease of any kind among our farm stock this year.

Seneca.—There has been no prevailing disease among either cattle, hogs, or sheep. A few horses have died of distemper. Hen cholera has prevailed, causing a loss, perhaps, of \$4,000 in the county.

Suffolk.—The most fatal diseases among horses in this county are lock-jaw and spinal meningitis. Scab has proved very fatal to sheep.

Tioga.—There has been no disease of an epidemic or fatal character among our farm stock this year.

Warren.—The losses among the various classes of domestic animals and fowls in this county for the past year have been so small, that I am satisfied no disease of an epidemic character has occurred.

Washington.—There has been some pink-eye among horses and pneumonia among cattle. Hogs have suffered with staggers, sheep with colds, and fowls with the usual

diseases. The value of the losses for the year are about as follows: Horses, \$4,500; cattle, \$5,000; hogs, \$3,300; sheep, \$2,400; fowls, \$4,000.

Wayne.—No destructive disease seems to have prevailed among any class of farm animals in this county the past year.

Wyoming.—No fatal disease has prevailed among any of our farm animals this year.

Yates.—Pink-eye has prevailed to some extent among our horses, but in rather a mild form. Chicken cholera prevails in this locality, and seems to be very contagious. Turkeys are occasionally attacked and die. It is plainly a disease of the bowels. Some seasons the value of the losses in this county will reach \$1,000.

NORTH CAROLINA.

Alexander.—There has been no prevalent disease among farm stock in this county the past year, and no data upon which to base an opinion as to the number of animals that have been attacked and died within the year.

Alamance.—I have no diseases to report as prevailing among our farm animals at present. There has been no hog cholera this season. About 75 per cent. of the animals die when it prevails.

Ashe.—None other than the common well-known diseases have prevailed during the year among the live-stock of this county.

Carteret.—The losses from diseases among domestic animals have been comparatively small in this county the current year.

Caswell.—A few hogs and fowls have died during the year of diseases incident to them.

Clay.—Cholera has prevailed among the hogs and fowls of this county to a limited extent during the year. Horses, cattle, and sheep have remained healthy.

Columbus.—Farm animals are generally healthy, at least no contagious disease prevails among any class, except among hogs. They are afflicted with cholera, as are also our fowls. We have found no remedy for this disease.

Cumberland.—With the exception of hogs, all our domestic animals seem to have been very healthy the past year. Some years the loss is very heavy among these animals.

Dane.—A number of horses along the beach have died of blind-staggers. Cattle, hogs, and sheep have been very healthy. A great many sheep have been killed by dogs.

Davidson.—Several of our farmers have lost their hogs—almost their entire stock—by a disease which carried them off very rapidly. They broke out in boils which had a very offensive odor. The animals only lived about 36 hours after the attack was noticed. So offensive were the tumors that the buzzards were attracted while the animals were yet living. The boils could be penetrated to a depth of an inch or more.

Forsyth.—There have been no fatal diseases among our farm animals during the year. A great many fowls have died of cholera.

Franklin.—The only loss of any importance among any class of our farm animals during the year has been among hogs by the usual diseases incident to these animals.

Gaston.—A few horses and cattle have died of disease during the past year, but not many. Hogs are the most unhealthy of all classes of farm stock. They die mostly of cholera. A great many fowls are also lost by cholera.

Gates.—I am unable to furnish the information desired in your circular.

Greene.—Since the enactment of the stock law diseases among farm animals are not so prevalent. We have had a few cases of cholera among hogs, but the disease has not been widespread as in former years.

Halifax.—All kinds of farm animals have been free from disease, and the losses during the year amount to but little. Occasionally cholera appears among our fowls.

Harnett.—Cholera has been quite fatal among our hogs. At least one-half of those attacked have died.

Henderson.—I find it impossible to procure the statistics relating to losses among farm animals.

Iredell.—Our farm animals have been unusually exempt from disease, especially of a fatal character. The losses will not exceed, in value, over \$3,000 or \$4,000 for the entire county.

Jones.—There is not much attention paid to stock in this county. The animals are allowed to roam at large and take care of themselves. But few losses have occurred from diseases.

Montgomery.—We have no reliable basis from which to report, and do not propose to guess. The returns of assistants are not reliable, and I do not propose to make a statement unless based on some facts measurably reliable.

Onslow.—Cholera has prevailed among hogs and fowls in this county. No other disease of a contagious character has appeared among stock. The value of the losses among the various classes for the year may be stated thus: Horses, \$16,250; cattle, \$2,475; hogs, \$1,800; sheep, \$312.50.

Pamlico.—About 40 horses have died in this county this year of blind-staggers. The losses have not been heavy, but more or less disease has prevailed among the other classes.

Pasquotank.—No special disease has prevailed among any class of our farm animals this year, except cholera, which has caused the death of a limited number of hogs.

Pender.—Blind-staggers has been quite fatal to a number of horses in this county, and cholera has prevailed quite extensively among hogs and fowls. The value of the horses lost may be stated at about \$3,000, and hogs a like amount.

Polk.—Farm stock has generally been healthy. There have been some cases of cholera among hogs, but I am of the opinion that 15 per cent. would fully cover the loss for the year. Among horses and cattle the losses will not exceed 5 per cent.

Randolph.—Losses among horses and mules, \$3,175; cattle, \$500; hogs, \$1,446; sheep, \$520; fowls, \$219.

Robeson.—Horses have been exceptionally healthy this year. Cattle have been afflicted with murrain. Warm winters seem to be more unhealthy for cattle than cold weather. Hogs are afflicted with cholera, and about all that are attacked with the disease die. We have no remedy for chicken cholera, although the disease is widespread and fatal.

Rutherford.—Horses have suffered with distemper, glanders, and blind-staggers, and cattle with distemper and murrain. A large number of hogs have died of cholera, and a few sheep have been lost by scab. Fowl cholera prevails.

Surry.—No fatal diseases have visited the farm animals of this county during the current year.

Transylvania.—The losses from disease among all classes of farm animals in this county for the past year will aggregate about \$5,000.

Union.—The horses and cattle in this county have been remarkably free from disease the past year. Dogs have killed about 225 sheep. A considerable number of fowls have died from cholera and sore-head.

Wayne.—No special disease has prevailed among the live-stock of this county. Cholera has been quite destructive to fowls.

Wilkes.—The aggregate loss among all classes of farm stock and fowls in this county for the year may be stated at about \$8,000.

Wilson.—Hog cholera prevailed to a wide extent in this county in 1882. I lost hogs myself valued at \$500. I suppose the loss in the county that year reached \$6,000 or \$7,000. Our experience is that it does no good to doctor animals suffering with the disease. Generally about 75 per cent. of the fowls attacked with cholera die.

Yadkin.—No destructive disease has prevailed among farm animals in this county. All classes are in a healthy condition.

Yancey.—No very fatal or widespread disease has visited any class of our live-stock this year.

OHIO.

Allen.—The losses from diseases among farm animals were quite heavy for the past year in this county. The values are given as follows: Horses, \$10,832; cattle, \$6,202; hogs, \$18,350; sheep, \$2,425.

Ashtabula.—No destructive diseases have visited the live-stock of this county during the year, and hence the losses have only been nominal.

Auglaize.—While no special epidemic seems to have prevailed among any class of farm animals in this county, the losses for the year are quite heavy. They are given as follows: Horses, \$9,746; cattle, \$4,717; hogs, \$13,100; sheep, \$1,085.

Brown.—I find it impossible to make a correct statement in regard to losses of farm stock in this county, and therefore think it best not to make any.

Carroll.—No diseases have prevailed among either horses, cattle, or hogs. Some flocks of sheep are affected with foot-rot, but not many die of the disease. Occasionally they die of grub in the head. Fowl cholera is often quite destructive, but the disease does not seem to prevail at this time.

Champaign.—Only sporadic cases of disease have occurred among our farm animals during this year. Fowls die by the dozens on many farms, but there are no records showing the number lost.

Crawford.—No disease among horses. Cattle and hogs are healthy and in good condition. There is some foot-rot among sheep, and a great deal of cholera among fowls.

Clinton.—The following are the estimates of the losses of farm animals in this county for the past year: Horses, \$16,800; cattle, \$5,190; hogs, \$14,416; sheep, \$2,428.

Coshocton.—No epidemic disease has occurred among our farm stock this year.

Darke.—Horses and cattle are healthy. Cholera or splenic fever has, and still is raging among hogs in some sections of the county. I have no data as to the value of the losses, but the aggregate will be large. There are isolated cases of cholera among fowls.

Defiance.—No disease of any kind among stock. Nothing but natural causes occasion losses.

Delaware.—There were killed by dogs in this county during the year 335 sheep, valued at \$1,262. A number of cattle and hogs have died of the diseases incident to such stock. The value of the cattle lost was \$6,272, and of hogs \$7,234.

Fairfield.—All kinds of farm animals have been free from disease. No signs of an epidemic, and no losses worth mentioning.

Fayette.—No losses of consequence have been occasioned by disease among the farm animals in this county.

Franklin.—No epidemic has occurred among our horses and cattle. Hogs have suffered from cholera, which has lessened the production more than one-half. It is very fatal; 90 per cent. of those attacked die. The value of our losses among these animals will reach \$37,000 or \$38,000.

Geauga.—No destructive disease has appeared among any class of our domestic animals this year.

Harrison.—The losses of farm animals in this county by disease during the current year have been only nominal.

Henry.—Distemper prevailed to some extent among horses the past winter and summer, but was of rather a mild form. The value of the hogs lost by disease will amount to \$16,000. Cholera has been quite fatal to some flocks of fowls, while others have remained exempt from the disease.

Hocking.—I estimate the value of losses among farm animals in this county for the year as follows: Horses, \$4,780; cattle, \$2,736; hogs, \$1,913; sheep, \$3,778.

Holmes.—Milk fever has been very fatal to dairy cows in this county. Animals of this class valued at \$10,000 have died, mostly of the above-named disease. Hogs, by bunching and sleeping together in straw and manure beds, have become diseased.

While sleeping together in this way they get warm and sweat, and being called out to eat in the cold air they become chilled and thus contract disease. A large number of fowls have died of cholera.

Huron.—No epidemic is now prevailing among our farm animals, nor has anything of the kind prevailed among them during the year. Cholera prevails among chickens and turkeys.

Jackson.—Our farm animals have been reasonably healthy the past year, and consequently our losses have been only nominal.

Knox.—No special malady has visited any class of live stock in this county during the year, and the losses which have occurred have been from natural causes.

Licking.—There has been no epidemic among horses, yet some have died of disease. Cattle generally are healthy, yet there have been a number of deaths from milk fever. Sheep have suffered from a disease known here as "white skin," which seems to be attributable to the past wet season. Cholera and thumps have caused the loss of some hogs, yet neither disease can be said to prevail at present. Cholera prevails quite extensively among fowls, and few that are attacked recover. The value of the losses are estimated as follows: Horses, \$11,040; cattle, \$4,290; hogs, \$1,556; sheep, \$19,797; and fowls, \$10,619.

Logan.—There has been very little disease among horses except pink-eye, and that seldom proves fatal. Hog cholera has not been as bad as it was a year or two ago, yet the value of the losses in this county will reach over \$30,000. Foot-rot and paper skin have destroyed sheep valued at \$9,435. Chicken cholera has caused considerable damage.

Lorain.—A few cows have been lost by milk fever, and quite a number of sheep by paper skin and grub in the head. The value of sheep thus lost in the county will aggregate about \$7,000.

Lucas.—It is difficult to determine with any degree of accuracy the number or value of farm animals lost in this county by disease during the year. The following is thought to be a fair estimate of the value of those that have died: Horses, \$6,981; cattle, \$3,472; hogs, \$2,744; sheep, \$959.

Mahoning.—There is no epidemic disease prevailing among farm stock in the county. Some pink-eye occurred during the year among horses, but there were no losses.

Meigs.—The heaviest loss that has occurred among any class of farm stock has been among sheep. The losses have been principally among lambs just coming in, and yearlings. Some farmers have lost a large per cent. of such animals. The nature of the disease is not known. The total amount of the loss will reach about \$8,000.

Miami.—I cannot learn of the prevalence of any fatal diseases among live stock. They all seem fat and healthy.

Montgomery.—The following is as near an approximation of the losses of farm animals in this county for the year as it is possible to obtain, viz: Horses, \$17,780; cattle, \$2,000; hogs, \$12,600; sheep, \$4,000; and fowls, \$250.

Morgan.—The statistics desired cannot be obtained.

Morrow.—Neither our horses, cattle, nor hogs have been visited by any epidemic or contagious disease for some years past; therefore the losses have not been great. This is a sheep county. The latter part of last winter was very hard on this stock, particularly those that were not sheltered. There was a heavy loss among lambs. The total loss is estimated at \$18,350.

Muskingum.—The largest loss in this county has been among sheep. Farmers know but little about the symptoms and nature of diseases; hence it is difficult to tell what they die of. The losses among the various classes are estimated as follows: Horses, \$9,416; cattle, \$7,806; hogs, \$1,961; sheep, \$17,566.

Ottawa.—The entire animal kingdom is free from all diseases as far as I can learn.

Paulding.—A few cases of pink-eye have occurred among horses, but nothing like an epidemic has prevailed. There have been some cases of murrain and red-water

among cattle. Hogs seem to have been healthier than usual. Some fowl cholera prevails, but to what extent I am unable to say.

Preble.—The loss of hogs in this county has been quite heavy, and will amount in value to \$32,524. There does not seem to have been any unusual epidemic among this or any other class of farm stock, and the aggregate loss for the year is about an average. Fowl cholera has prevailed quite extensively.

Seneca.—The loss among hogs in this county is estimated at \$10,000. The diseases affecting these animals are cholera, thumps, staggers, and rheumatism. Fowl cholera visits us with unwelcome regularity. The value of the losses for the year will reach \$5,000.

Stark.—We have had no special or very fatal diseases among our farm animals for the past year. The losses are therefore only nominal.

Trumbull.—No epidemics have prevailed among our farm animals during the year.

Tuscarawas.—All classes of domestic animals are free from contagious and infectious diseases.

Union.—A great many animals of all classes have died during the past year of diseases incident to them. Among the horses lost were several very valuable imported ones. The losses among the various classes are given thus: Horses, \$12,760; cattle, \$4,100; hogs, \$25,709; sheep, \$9,994.

Vinton.—There seems to be no complaint as regards the health of domestic animals in this county. Isolated cases of fowl cholera are reported.

Warren.—I hear of the prevalence of no epidemic except that known as cholera among hogs and fowls. The value of the hogs lost in the county will reach \$18,000 and upwards, and of chickens about \$250.

Wayne.—The present year has been remarkable for the good health of all classes of farm stock.

Wood.—I hear of no epidemic disease except cholera among fowls. Our losses have been quite heavy from this disease; will amount in value to \$1,500.

Wyandot.—The total value of the loss of farm animals in this county for the year will reach \$7,000, divided among the various classes and fowls as follows: Horses, \$2,000; cattle, \$500; hogs, \$2,500; sheep, \$1,000; and fowls, \$1,000.

OREGON.

Baker.—Pink-eye has prevailed to some extent among horses, but it has not proved fatal in any case that I have heard of. A few cases of black-leg in calves have occurred.

Benton.—But few animals have died from the effects of disease in this county the current year, and those that have been lost have died of the usual well-known diseases.

Clackamas.—The only disease worthy of note among any class of farm animals has been among horses. They are afflicted with enlargement of the kidneys, which seems to cause the bots to leave the stomach and go to the throat. Some cases have proved fatal. There have also been some cases of blind-staggers among horses.

Clatsop.—Five per cent. of the sheep of this county are usually lost by disease. About one-third of this number die from the effects of the water-leech.

Columbia.—No epidemic disease has prevailed among any class of live stock in this county during the past six years. Our hogs are mostly of the old long-nosed breed, and hunt their living until they are wanted for fattening purposes.

Curry.—Some flocks of sheep are affected with scab, but the disease rarely proves fatal. All other classes of farm animals are in a remarkably healthy condition.

Josephine.—There are but a small number of domestic animals in this county, and the few we have are in a healthy condition.

Lane.—Since 1881 the horses in this county have suffered seriously, and often fatally, from an epidemic not understood by our people. The disease, I presume, is glanders. The symptoms are a swelling under the jaw and a free discharge at the nostrils of a grayish sticky matter. Sometimes one nostril or the other discharges

blood, and small blood-blisters appear upon the hind legs of some, which break, discharge, and heal. The hair sticks out from the bodies of the animals, their appetites fail, and soon they run down and die. The disease is contagious in a high degree. Many fine animals, worth thousands of dollars, have died of the malady. The loss, I think, will aggregate \$10,000 annually. Sheep are occasionally affected with scab; and rouse, which is contagious, frequently sweeps off large numbers of fowls.

Linn.—In some sections of our county horses are occasionally affected with lung fever and staggers. A few die of nasal gleet, or some disease resembling catarrh. Sheep are subject to leech and scab, and chickens to cholera.

Multnomah.—No contagious disease has prevailed among any class of our domestic animals.

Polk.—The only loss we have sustained among our farm animals has been among horses and sheep. No contagious disease seems to have affected any class.

Washington.—We have here every winter a disease among horses, called staggers by some, and by others spinal meningitis. I hear of some suffering thus early in the winter season. I estimate the average annual loss by that disease alone at 8 per cent. There has been no fatal disease among other classes of stock. Cholera among fowls has prevailed to a limited extent.

PENNSYLVANIA.

Allegheny.—There has been no disease of any kind among our farm animals. Cholera among fowls has been quite prevalent.

Bedford.—A number of horses have suffered with pink-eye, distemper, and lung fever. Hog cholera has prevailed, and fowls have also suffered with cholera and gapes. The losses are estimated as follows: Horses, \$35,000; cattle, \$1,600; hogs, \$10,000; sheep, \$6,000; fowls, \$2,500.

Bradford.—No contagious disease has prevailed among live stock in this county the past year.

Butler.—I cannot hear of the prevalence among either horses, cattle, hogs, or sheep of any disease whatever. The deaths have been the result of accident, natural defects, or for lack of proper care.

Cambria.—No disease of a fatal character has prevailed among any class of our domestic animals.

Cameron.—But few losses have been occasioned by disease among the farm animals of this county during the past year.

Clinton.—I find it impossible to furnish the information you desire as to losses from disease among farm animals.

Crawford.—No contagious or epidemic disease has prevailed among any class of our farm stock the past year. Animals occasionally die, but generally of some common disease, old age, &c.

Elk.—The losses among domestic animals in this county are occasioned by bad treatment, old age, or accident.

Erie.—We have had no prevailing disease within the past year among any class of our farm animals, but we have had the average annual losses from old age, accident, want of proper attention, &c.

Greene.—There never has been an epidemic among the farm animals of this county that amounted to anything. Chicken cholera has caused greater losses than any disease among live stock.

Lawrence.—There has been some chicken cholera among fowls, but the disease has not been so general as heretofore. No epidemic has visited our farm animals during the year.

Lycoming.—No contagious or infectious disease has prevailed among our domestic animals the past year. The losses have been occasioned by natural causes.

Montour.—Some hogs have died in this county during the year. It is supposed that

the disease of which they died was occasioned by feeding them with moldy corn. About one-third of our chickens have died of cholera.

Northampton.—No epidemic disease has prevailed among any class of farm animals in this county. The chicken disease has caused considerable loss. It has also attacked turkeys with fatal results.

Schuylkill.—No serious or destructive disease has visited our live stock the past year.

Somerset.—I am of the opinion that there has been no epidemic disease among our stock for two or three years past, but of course there have been some deaths from natural causes and common ailments.

Sullivan.—This is a high, rolling county, with fine nutritious grasses, and is very healthy for all kinds of farm animals. The losses the past year were only nominal.

Susquehanna.—Scarcely any losses have occurred among our farm stock from disease the past year. There has been quite a heavy loss among sheep, caused by dogs.

Union.—No contagious diseases have made their appearance among our farm animals the past year.

Venango.—There is not, nor has there been during the year, any contagious or infectious diseases among our domestic animals. The losses are such as are incident to all stock.

Warren.—Of course an animal occasionally sickens and dies, but I can hear of the prevalence of no epidemic among our stock during the current year. One butcher—an isolated case—lost some hogs by cholera.

Washington.—A few horses, cattle, hogs, and sheep have died from the effects of the various diseases incident to them during the past year. I cannot give the value of such losses. The cholera or roupe has been destructive to fowls. The loss will aggregate several thousand dollars for the year.

Wayne.—No contagious or epidemic diseases among farm stock in this county. A great many calves and yearlings have died of malignant anthrax or black-leg. From 200 to 300 sheep are annually killed by dogs.

Westmoreland.—Farm animals usually do well in this county. I can procure no reliable data as to annual losses by disease. The aggregate would amount to but little.

Wyoming.—I have no diseases to report as prevailing among farm animals. I estimate the value of the loss of fowls at \$2,375.

York.—I estimate the value of the losses among the various classes of farm animals and fowls in this county for the year as follows: Horses, \$8,500; cattle, \$2,000; hogs, \$2,000; sheep, \$65; and fowls, \$500.

RHODE ISLAND.

Bristol.—The prevailing horse disease has been pink-eye, of which few animals, however, die, and those chiefly from ignorance. A small, cheap pamphlet, in large type, describing the more frequent diseases incident to horses and cows, and indicating proper treatment, would save much loss and untold suffering to the animals.

Kent.—The most prevalent disease among horses is pink-eye. Hogs have fevers from exposure, and fowls are afflicted with roupe, caused by their damp quarters.

Newport.—The loss among farm animals in this county during the past year has not been very large. Nothing like an epidemic disease has prevailed. A large traffic in the production of eggs has within the past few years grown up in the southern part of the county.

SOUTH CAROLINA.

Barnwell.—Horses, cattle, and sheep in this county are remarkably free from all contagious diseases. They die from such sporadic attacks as are common everywhere, and in some cases from poverty and bad treatment. Hogs and fowls are suffering from a disease called cholera, of which numbers are being carried off. We have no remedy.

Chesterfield.—I have not heard of the prevalence of any fatal disease among the farm animals of this county during the past year.

Clarendon.—The only loss of any consequence that has occurred among any class of stock in this county during the year has been among hogs. The value of the animals lost will aggregate \$10,900. Fowl cholera has been widespread and destructive, and has destroyed fowls valued at \$2,350.

Hampton.—I am unable to furnish the information desired for this county.

Newberry.—Horses occasionally die of common ailments. Cattle die of "hollow-horn" and exposure. No care is given these animals. Cholera is very fatal to both hogs and fowls. No unusual epidemic has prevailed among our animals during the year.

Richland.—Cholera has prevailed to a considerable extent among hogs in this county. Other farm animals have remained healthy.

Sumter.—All classes of farm animals in this county are free from disease.

Williamsburg.—No statistics accessible, and cannot give the information desired.

TENNESSEE.

Anderson.—This has been a year quite free from stock epidemics. In the early spring quite a number of milch cows died of a disease popularly known as murrain, and a few hogs of cholera.

Bedford.—The only disease from which our horses suffer is distemper, with occasionally a chronic ailment. A disease has prevailed the past summer among our cattle called murrain by some and by others Alabama or Texas fever. It only affects native cattle which are grazed on pastures after Alabama or Texas cattle. Strange to say, the Southern cattle are never affected, but fatten well, while native cattle that follow in the same pastures sometimes die by the herd. Hogs and fowls are affected by cholera.

Benton.—Some horses were killed in this county during the year that were supposed to be suffering with glanders. But little disease has prevailed among cattle. Hogs valued at about \$2,000 have died of disease. Fowl cholera has been quite destructive.

Blount.—There has been no disease of an alarming character among our farm animals the past year. Swine plague was very destructive in 1882.

Bradley.—The only disease of consequence that has visited any class of stock in this county the present year is what is generally known as murrain among cattle. Cholera among fowls prevails to a wide extent.

Claiborne.—No diseases prevail among our horses, cattle, or sheep. Swine have suffered with swine plague, and fowls with cholera. These diseases have not been so destructive, however, as in some former years.

Coffee.—For several years past but few diseases have prevailed among any class of our farm animals except hogs.

Cumberland.—Our horses, cattle, sheep, and fowls have been unusually healthy the past year. In one neighborhood hogs were afflicted with cholera, which resulted in a loss of about 200 head of all ages. The disease is not now prevailing.

Davidson.—I find it impossible to procure the information you desire.

Decatur.—There has been but little disease among farm animals in this county the past year. Several cattle died, but of what disease I am not informed.

De Kalb.—There has been a great deal of cholera among hogs in some parts of this county this year, and very little disease of any kind among other classes of farm stock. Cholera has also been very destructive to chickens, turkeys, &c., in certain localities.

Dickson.—No diseases among horses or cattle in this county. Some cholera among hogs and fowls, and occasionally rot among sheep.

Fayette.—No diseases prevalent among horses, cattle, sheep, or fowls, but hog cholera has prevailed to some extent in different localities in the county.

Gibson.—No disease except ordinary distemper among horses. Bloody murrain and Texas fever reported in two or three neighborhoods; very fatal. In three or four districts cholera is reported as being very fatal to hogs, especially to fattening hogs. Gapes quite often prove fatal to young fowls and cholera to older ones.

Giles.—Horses are quite healthy. The loss of cattle is the result of contagious diseases produced by the importation of cattle from the mountainous districts of Alabama. There should be a law enacted by the present Congress to prevent the importation of stock from one State to another in such cases. The disease has proved fatal in every instance to native stock. Our county has lost many hundreds of dollars by the importation of such stock. Our losses for the year are estimated as follows: Horses, \$12,750; cattle, \$18,750; hogs, \$20,000; sheep, \$850, and fowls, \$1,200.

Granger.—There has been some hog and fowl cholera in this county the past year, but as to the extent and value of the losses no one knows. Cattle, horses, and sheep seem to have been free from disease.

Greene.—Cholera has prevailed among hogs and chickens in some localities in this county. A few horses have suffered with blind staggers. Hog raising is still declining in favor of cattle growing.

Hancock.—One-fourth of the hogs of this county have been affected with cholera during the fall season, and the disease is still raging with great destruction. Some cattle have died of murrain; fowls have died of cholera, and chickens of gapes. I estimate the value of cattle and hogs lost as follows: Cattle, \$1,080; hogs, \$17,500.

Hardeman.—No epidemic disease has prevailed during the year among any class of our domestic animals except among hogs. Fowls have suffered also to some extent. The disease prevalent among both hogs and fowls is known as cholera.

Haywood.—No disease of a general character has prevailed among any class of farm animals in this county the past year. All that have been lost is the result of old age or neglect. Our county is in a prosperous condition as regards stock of all kinds.

Henderson.—Cattle have been affected in some localities with what is here called bloody murrain. The true nature of the disease is little known. It usually proves fatal. Hog cholera has prevailed to some extent in certain localities, but the disease is not general throughout the county.

Hickman.—Hog cholera prevailed in this county to an alarming extent during the year 1882. More than 75 per cent. of the hogs died that year. It has not prevailed in a destructive form since. A few cases of pink-eye occurred among cattle the past spring and summer, but there were no deaths.

Humphreys.—I estimate the value of hogs lost by cholera in this county the past year at \$10,000. Cholera has also prevailed among fowls, and has been quite destructive.

James.—The most fatal epidemic we have to contend against is that called murrain among cattle. It is called both bloody and dry murrain, and kills almost every animal it attacks. Unless some remedy is found for this malady, it will destroy the cattle interest in this section.

Johnson.—In the early spring horses were affected to some extent with pink-eye. Cattle have suffered with black-leg, hogs with cholera, sheep with pneumonia, and fowls with cholera.

Knox.—Only a small number of our farm animals have been affected by disease, and but few of those affected have died. No epidemic worthy of mention has occurred. There have been a few cases of cholera among hogs and fowls, but the losses have not been so great as in former years. A few deaths have occurred among cattle, caused by the introduction of animals from more southern States. For instance, one farmer bought a car-load of cattle in Alabama, some hundred miles south of this locality, and brought them to his farm to pasture through the summer. These cattle did very well, but almost all the native cattle on the farm died. The cause and nature of this disease is not understood here.

Lake.—The value of the farm animals and fowls lost in this county the past year

by the various diseases incident to them is estimated as follows: Horses, \$6,000; cattle, \$1,620; hogs, \$42,750; sheep, \$64; fowls, \$279.

Lawrence.—A few horses have died during the year of blind staggers. Dry murrain has been very fatal to cattle in some localities. Hog cholera has prevailed, and has been very fatal along the large water-courses. Animals on the uplands have remained healthy.

Loudon.—No disease of fatal character has prevailed among any class of our domestic animals the past year. Occasionally an animal dies, but not of a contagious disease.

Madison.—The losses among some classes of farm animals have been quite heavy in this county during the past year. I estimate the value of the losses among all classes as follows: Horses, \$7,500; cattle, \$10,000; hogs, \$20,000; sheep, \$900; and fowls, \$360.

Meigs.—All kinds of farm animals have been in good health the past year. There has been some cholera among chickens, but I have no means of ascertaining the value of the losses.

Morgan.—Horses, cattle, and sheep have remained free from disease during the year. Cholera has prevailed to a considerable extent among hogs and fowls. Value of hogs lost, \$6,000; fowls, \$800.

Montgomery.—I find it utterly impossible to furnish the information you desire.

Moore.—An estimate of the value of the animals lost in this county during the year is given as follows: Horses, \$6,000; cattle, \$4,000; hogs, \$2,500; sheep, \$400; and fowls, \$820.

Perry.—No disease of an epidemic character has prevailed among any class of farm animals in this county the past year. Cholera has prevailed among fowls, but I cannot give an accurate estimate of the value of the losses.

Pickett.—No epidemic among either horses or cattle. Some hog cholera, but not of an epidemic character. Not a great amount of disease among fowls.

Polk.—Horses have been healthy, and the same may be said of hogs and sheep. Our cattle have suffered with an epidemic of murrain. Fowls have been afflicted with cholera.

Putnam.—No disease of a very fatal nature seems to have visited any class of farm animals in this county during the current year. There has been some disease among sheep and also among fowls.

Robertson.—There has been no epidemic among farm stock in our county during the past year. A few hogs in some localities have had cholera and in others fowls have died of the same disease, but nothing like an epidemic has prevailed.

Shelby.—Some little cholera among hogs and fowls is now and then reported, but the losses have been small.

Sequatchie.—A considerable number of hogs have died of cholera during the year. A few horses have suffered with what is known here as pink-eye, but no deaths have resulted.

Sevier.—The disease known as hog cholera has prevailed to a limited extent during the year, but the losses have been comparatively small. Chicken cholera is less prevalent than usual.

Washington.—Heavy losses have occurred among swine and poultry in this county, caused by the ravages of cholera. Farm animals generally have remained free from fatal diseases.

Wayne.—There have been some cases of murrain among cattle and cholera among hogs. The disease was fatal to cattle, and three-fourths of the hogs attacked died.

White.—Hogs have suffered from cholera in some neighborhoods. Although the disease has not been general, I estimate the value of the losses at about \$8,000. Other classes of farm animals have remained free from contagious diseases.

Wilson.—Cholera has been very fatal to hogs, but I have no means of ascertaining the value of the losses. No special disease among other classes of stock.

Williamson.—All classes of domestic animals have been remarkably free from con-

tagious diseases except hogs. There have been a few causes of cholera among these animals. Cholera is now prevailing and proving quite fatal to fowls.

Unicoi.—No diseases of a contagious or epidemic character have prevailed among our farm stock the past year.

TEXAS.

Aransas.—No contagious disease has prevailed among any class of farm animals in this county the past year. Cholera is the prevalent disease among fowls, and annually kills large numbers of them.

Austin.—No disease among any class of farm stock, except the usual sickness among hogs. The losses have not been very heavy.

Bandera.—The only loss I have to report among our farm animals was among cattle, caused by the disease known as black-leg.

Bastrop.—I cannot give the statistics desired, but I am prepared to say that there has been no fatal diseases prevalent among our farm animals the past year.

Bee.—Horses, cattle, and hogs have been remarkably healthy the past year. Sheep have died of lombriz and scab, but owing to the dry weather they have been healthier than in former years.

Bexar.—No destructive disease has visited our horses, cattle, or hogs the past year. Scab prevails to some extent among sheep and cholera among fowls.

Bowie.—I have no diseases of a contagious character to report as prevailing among the farm animals of this county.

Brazos.—Sheep are the only class of animals that have been seriously affected by disease in this county. They have suffered with scab and foot-rot. Cholera among fowls prevails in some neighborhoods almost continuously.

Brown.—Horses, cattle, and hogs have escaped all epidemic diseases the past year. Sheep had a hard time of it last winter—no shelter and bad feed. About one-half or two-thirds of the number in the county died.

Caldwell.—Horses and cattle are healthy. Hogs are suffering with cholera, which is now prevalent in this county. Sheep are affected with scab. Cholera is prevalent and quite destructive to fowls. This disease annually destroys about half the hogs and fowls in the county.

Callahan.—A few horses have been attacked by blind-staggers during the past year, and about all attacked with the disease died. Cattle are plentiful here. I know of one man who owns 4,000 head, another 3,400, and several others who own from 800 to 1,200 each. They have been free from disease the past year. I have heard of some few deaths among young cattle just brought in. I think fine stock should be brought here in the late fall, say from October to December, in preference to the spring months. Hogs do well, and are healthy. Sheep have largely increased within the last year. There are probably more than 100,000 head in the county. Some few cases of scab prevail, but this usually only reduces the clip of wool and rarely kills the animal. Under the laws of Texas we now have a sheep inspector in each county, who examines diseased herds and prescribes proper treatment.

Cass.—Our losses among horses and mules the past year from blind-staggers were unusually large. This disease is supposed to be caused by eating smutty corn. Cattle are healthy, but a great many die annually from poverty and lack of proper shelter. Hogs are afflicted with cholera.

Chambers.—We have had so few deaths among farm animals the past year that the number is hardly worth recording. About 10 per cent. of our fowls are annually attacked by cholera, and 90 per cent. of those attacked die.

Cherokee.—No infectious or contagious diseases have attacked the farm stock of this county the past year.

Clay.—No epidemic of any kind has visited our farm animals this year.

Coleman.—Some little disease has recently appeared among horses in this county. Young cattle on the range are reported as suffering seriously with black-leg. Animals

valued at from \$10,000 to \$12,000 have been lost by the disease. A great many sheep died from the effects of cold and starvation last winter. Flock-masters were unprepared for the unprecedented cold weather, and were caught without either shelter or food. The loss is estimated at \$30,000.

Collier.—The only epidemic that has prevailed among any class of domestic animals is that known as cholera among hogs. A similar disease has prevailed among fowls.

Dallas.—I think, upon the whole, that our stock has been pretty free from epidemics of any kind. Hogs have suffered somewhat from cholera, and the same can be said in regard to fowls. We have but few sheep, and they are healthy and well cared for.

De Witt.—Our heaviest losses have been in sheep and cattle. This may partially be accounted for in the fact that neither class are properly sheltered and cared for during cold and inclement weather. A great many fowls have died of cholera.

Donley.—Horses in this county are frequently poisoned by the loco weed. We have no antidote for the poison, and it generally proves fatal. A great many cattle are annually killed by being crowded upon wire fences.

Eastland.—A very fatal disease known as black-leg has been quite prevalent among young cattle in this county. We have no remedy for the malady. The animal when attacked becomes indifferent, lame in forelegs, with slight swelling, feverish, considerable thirst, and finally drops down and soon dies. The disease terminates in death in about forty-eight hours after the first symptoms are shown. Calves and yearlings are the classes usually attacked. All other classes of animals have remained healthy.

Earth.—Blind-staggers, a very fatal disease to horses, has prevailed to some extent in this county the past year. A few cattle die annually of black-leg, and a large proportion of the fowls die of cholera.

Fannin.—The farm animals of this county have been exempt from all epidemic diseases during the past year.

Grayson.—Native cattle are very healthy, but imported animals almost invariably die. No fatal diseases among domestic animals this year.

Gregg.—A disease has prevailed among horses in this county for the past two years having all the symptoms of glanders, but it does not seem to be very contagious. I have seen some five cases. None have recovered. Sheep and cattle are free from disease. Hogs and fowls occasionally suffer from cholera.

Guadalupe.—No diseases of a contagious nature have visited our farm stock the past year.

Hardeman.—Both horses and cattle are often killed by eating the loco weed. It is more injurious to horses than cattle, and if the former should recover they are never of any use as work animals. Sheep are suffering to some extent with scab, and chickens are dying in considerable numbers of cholera.

Hardin.—All classes of farm animals are very healthy. At least 25 per cent. of the entire number of fowls in the county have suffered with cholera, and fully 90 per cent. of those attacked have died.

Henderson.—I have heard of the prevalence of no disease among horses and cattle this year. Hogs and chickens both seem to be suffering with cholera or some other fatal disease.

Johnson.—Farm animals of all kinds do well in this county and are moderately healthy. I have no means of ascertaining the value of the losses.

Jones.—There have been a few cases of pink-eye among horses. Five or six per cent. of the total number of sheep of this county died last winter of scab and poverty.

Karnes.—No epidemic has appeared among horses. Short and dry pastures in the early spring caused the loss of a great many cattle. These animals are now fat and healthy.

Kaufman.—The losses among our farm animals from disease during the past year have been comparatively small.

Kinney.—Sheep are affected with scab, but the disease now seems to be under control. The greatest loss has been felt in a reduction of wool.

Lampasis.—Sheep in this county have suffered severely with scab. Fully fifty per cent. of these animals have died from the ravages of this disease and of starvation. Horses and cattle seem to have suffered from scab also, which was communicated to them by grazing on the same pastures with the diseased sheep.

McMullen.—No epidemic has prevailed here, either among animals or fowls. During the winter of 1882-'83 about 20 per cent. of the sheep died from exposure to inclement weather, which was unusually severe for this latitude. Horses and cattle are now healthy and in good condition for the coming winter.

Madison.—Some cattle have died of the disease known as murrain. More hogs have died from eating cotton seeds than from actual disease. The greatest loss both to sheep and cattle has been the lack of proper shelter.

Marion.—No wide-spread or epidemic disease has prevailed among any class of domestic animals in this county the past year.

Matagorda.—No contagious disease has appeared among our farm animals this year. Flies and the screw-worm have caused the death of a great many sheep.

Menard.—Horses have been affected with a disease known here as loin distemper. Scab is prevalent among sheep, and has caused some losses. Cattle and hogs are healthy.

Morris.—The only fatal disease to which our horses are subject is blind or sleepy staggers. But few animals recover from this disease. A few cases of cholera have been reported among hogs. A similar disease is often very destructive to fowls.

Parker.—Stock of all kinds was never in better condition than at present. The loss on all range stock last winter was estimated at 2 per cent.

Polk.—No losses of any consequence among any class of domestic animals in this county.

Runnels.—There is no prevailing disease among our farm animals, and the losses are principally caused by starvation. The losses for all classes will not exceed 10 per cent.

Rusk.—Hog cholera is now prevailing on many farms, and some farmers have lost a large per cent. of their fattening hogs. They die very suddenly, only refusing to eat a day or so before death occurs. No remedies seem to have any effect. A change of range has been found beneficial. Other farm animals have continued healthy. One of my neighbors, having good Bermuda grass pastures, imported from Ohio in the month of October thirty head of high grade Jersey cattle. The first half of October was hotter weather than we had in August. The thermometer ranged from ninety to ninety-five degrees daily on the north side of the house. In about a week after the arrival of the cattle some of them began to droop and refuse to eat. They were costive, and it was difficult to get an operation from the bowels with salts and other drenches. One very sick one was drenched with a quart of melted hog's lard, which operated, and the cow recovered and is now doing quite well. Of the thirty head, eleven died within about a period of twelve days. The remainder are now doing well. We attribute the cause of the sickness to the extreme hot weather and the sudden change of climate. Cholera is prevailing among fowls on many farms.

San Augustine.—No fatal disease has prevailed among any class of our domestic animals during the year.

Shelby.—We have had no epidemic among our farm animals this year. Some cholera has prevailed among hogs, and a few deaths have occurred, but the aggregate loss has been light. Chicken cholera has also prevailed.

Stephens.—No disease exists among farm stock in this county except scab in sheep, and as that disease rarely kills, the loss has not been very heavy. The "norther" struck our sheep just after being "dipped," and caused the death of a great many.

Throckmorton.—Heavy losses occurred among sheep in this county in 1882, caused by the animals eating a weed which grows on the ranges. Sheep feeding upon it would die in a few hours. I myself lost 400 head of high-grade Merinos, worth \$5 per head. Three hundred of this number died in two days. Similar losses extended over

the entire county. I telegraphed Dr. H. J. Detmers, who was then at San Antonio, requesting him to come and investigate the cause of the trouble, but he made no reply. I afterward wrote him and inclosed a specimen of the weed, but failed to elicit a reply. The only disease now prevalent is scab, which has resisted our efforts for many years, but we are now getting it somewhat under control.

Titus.—Horses have not suffered with any epidemic disease the past year. Cattle are generally healthy, though a good many die of poverty during the winter. Fowls die here with a disease known as cholera, and when it strikes a flock it seldom leaves one alive. We have no preventive or cure.

Tom Green.—Horses, cattle, and hogs seem to be in a healthy condition. Sheep are suffering with scab, but the losses on the ground are very small.

Trinity.—All kinds of domestic animals are free from contagious diseases. A disease of some kind prevails among fowls in certain localities.

Tyler.—No diseases of a destructive character have prevailed among any class of farm animals in this county the past year.

Washington.—No epidemic worthy of notice has appeared among any class of our farm animals the past year, though animals die occasionally from various causes. Some disease prevails among fowls.

Webb.—No epidemic has appeared among the domestic animals of this county during the years 1882-'83. Sheep raising is our largest interest. The losses among these animals are not large.

Williamson.—Poverty and neglect causes more losses among farm animals than disease. Distemper is the principal disease among horses and cattle. I have also to report a few cases of black-leg among young cattle, and some scab among sheep. Cholera prevails to some extent among fowls.

Victoria.—Our farm animals have never been visited by an epidemic of any kind.

VERMONT.

Bennington.—From all the information I can gather I am led to believe that the general condition of all farm animals in this county, as regards health, has been good. No disease of an epidemic nature has prevailed among neat cattle, and only the ordinary distemper of a mild character among horses. The only serious trouble we ever have among cattle is abortion in cows. The direct cause of this trouble has never been satisfactorily given.

Caledonia.—Several horses have died during the year with the following symptoms: First, dumpyish, unable to swallow, low pulse, cold extremities, difficulty in walking, and in two or three days down and unable to rise; hungry and thirsty, but unable to swallow, convulsions, and death in most cases in three or four days. On one farm three horses died in this way. The second and third were exposed to the first. What was the disease? Many young hogs have died suddenly. While apparently well they would give a piercing scream and drop dead, and the carcass would mortify in a few minutes. What was the disease?

Chittenden.—I find it impossible to give the statistics desired.

Lamoille.—No epidemic disease has prevailed among any class of our farm animals the past year, hence the losses have been very small.

Orleans.—All classes of farm animals in this county are very healthy.

Rutland.—There has been no prevailing disease among our farm animals. Horses occasionally have an epizootic cold, but these are not as severe or frequent as when the disease first appeared, and but few losses occur.

Windsor.—No diseases of a fatal character have prevailed among any class of farm animals in this county during the current year.

VIRGINIA.

Albemarle.—There has been some cholera among hogs, but the fatality has not been great. Some cattle fever was brought here by the importation of some cattle from

the south side of the James River. This disease was more extended this year than last.

Amelia.—I give the value of the losses among farm animals as follows for the past year, viz: Horses, \$2,000; hogs, \$3,000; sheep, \$4,000; and fowls, \$2,000.

Bath.—I have no losses to report among the farm animals of this county as the result of contagious or epidemic diseases.

Bland.—No contagious diseases have prevailed among any class of our farm stock during the past twelve months.

Buchanan.—All farm animals have been entirely free from diseases the past year except horses. An occasional case of distemper has occurred among these animals, but I have heard of no deaths resulting.

Caroline.—Distemper among horses has been the most prevalent disease that we have had to contend with among farm stock. Considerable disease has existed among chickens.

Clarke.—So far as I have been able to learn, no epidemic diseases have appeared among any class of our farm animals the past year. In 1882 hog cholera prevailed extensively, and entailed a loss of, say, 500 animals, valued at \$1,500.

Essex.—All classes of farm animals have enjoyed remarkably good health during the past year.

Fairfax.—There seems to be no disease of a fatal character prevailing among any class of farm stock in this county.

Frederick.—From the best information I have been able to obtain I am satisfied there has been but little disease prevalent among our farm animals the past year. A few hogs and fowls have died of a disease generally designated as cholera.

Greene.—No losses of consequence have occurred from disease among farm animals in this county the current year.

Hanover.—But few losses have occurred from disease among the farm animals of this county the past year. I estimate them as follows: Horses, \$2,500; cattle, \$1,000; hogs, \$400; sheep, \$360; and fowls, \$250.

Henry.—No diseases have prevailed among horses and less than the usual number among cattle. Hogs and fowls have suffered to some extent with the usual maladies.

Highland.—No epidemic disease has visited any class of farm animals in this county the past year.

Isle of Wight.—Sheep have died of some kind of head or brain disease. Hogs for many years, and especially the past, have suffered greatly from the ravages of cholera. They rarely ever recover from an attack, and if they do, are rarely of any value thereafter. Great numbers of fowls also annually die of a disease called cholera.

James City.—Horses, cattle, and sheep are healthy. Hogs are affected with cholera and mange. Fowls, especially hens and turkeys, suffer severely with cholera. If you could banish this disease from this county the raising of fowls would be most profitable.

King and Queen.—From the best information I can get I am satisfied that our losses among farm animals have not been very heavy the past year. The following is regarded as a fair estimate of the value of the animals that have died of disease: Horses, \$2,000; cattle, \$1,500; hogs, \$2,000; sheep, \$250; and fowls, \$625.

Lancaster.—I find it impossible to furnish the information called for by your circular.

Louisa.—We have had no epidemic among horses, cattle, or sheep. In some neighborhoods we have had what was supposed to be cholera among hogs, a disease which proved quite fatal to the animals attacked. The same might be said of fowls. Of the number of the latter attacked more than 50 per cent. died.

Lunenburg.—No infectious or contagious disease has prevailed among our farm animals the past year. There have been some losses among fowls by the usual disease.

Matthews.—No special disease to report as prevailing among farm animals. A great many fowls die of cholera.

Mecklenburg.—Distemper has prevailed quite extensively among horses, and while it has rarely proved fatal, it has been very inconvenient. There has also been some distemper among cattle and cholera among hogs. A great many hogs have also died from eating poisonous mushrooms.

Montgomery.—The loss during the past year among hogs and fowls has been heavy. It is difficult to get reliable figures, but I think at least 70 per cent. of the hogs of the county have died during the year, and perhaps 20 per cent. of the fowls. Garden rue is used successfully as a preventive of chicken cholera. It is used as a tea, which the fowls drink instead of water.

Northampton.—For the past twelve months the domestic animals in this county have been extremely healthy.

Orange.—I find it impossible to give anything like an accurate estimate of the value of losses among farm animals in this county for the past year. No epidemic disease has prevailed among any class.

Princess Anne.—The only animals that have suffered from disease this year have been hogs. The disease is not so wide-spread as in former years, and seems to be of a different character. It is called "thumps." Fatal diseases have prevailed among fowls.

Prince Edward.—The following is regarded as a fair estimate of the value of the losses among farm animals in this county for the past year: Horses, \$4,600; cattle, \$950; hogs, \$600; sheep, \$138; and fowls, \$500.

Richmond.—I have heard of no diseases worthy of reporting among our domestic animals and but very little among fowls. Fowls suffer most from the disease known as cholera.

Spottsylvania.—Horses have suffered to some extent with pink-eye and distemper. A great many hogs have died of cholera and black-tooth. Cattle and sheep have been free from disease. Fowls have been afflicted with cholera.

Tazewell.—The principal loss among cattle is caused by a disease known among us as black-leg. The disease attacks the fattest animals only, and those that are attacked live but a few hours.

Wise.—Hogs are the only farm animals in this county that have suffered during the past year with anything like a contagious disease.

WEST VIRGINIA.

Barbour.—No diseases prevalent among horses. Diseases among cattle are confined mostly to young stock. The loss among these animals has been quite heavy, and will amount in value to over \$7,000. Cholera has prevailed extensively among fowls and has been quite fatal.

Berkley.—No destructive disease has visited any class of our domestic animals the past year.

Boone.—Losses caused among our farm animals by disease during the past year have been very small.

Cabell.—Hog cholera is about the only disease that has proved destructive to our farm animals the past year. It is now prevailing and generally proves fatal.

Doddridge.—The following I regard as a correct estimate of the value of the losses among farm animals in this county the past year: Horses, \$400; cattle, \$3,375; hogs, \$3,000; sheep, \$1,250; and fowls, \$2,500.

Fayette.—The only losses of consequence sustained among any class of farm animals by disease the past year have been among hogs.

Gilmer.—No contagious or epidemic disease has prevailed among any class of domestic animals in this county the past year.

Grant.—A majority of the farm animals of this county have maintained good health the past year. There has been some cholera among both hogs and fowls.

Greenbrier.—There have been some cases of pink-eye among horses and black-leg among yearling calves. Hogs have suffered with a disease supposed to be cholera.

They have a cough and soon quit eating. Nearly all the young animals affected die. The disease seems to be confined to localities where the hogs feed on acorns. Cholera also prevails among fowls, and the losses have been quite heavy.

Hardy.—Very little disease among horses. Cattle have suffered with black-leg, hollow-horn, murrain, and foot-evil. Last spring our young hogs died of cholera in certain localities like flies. Sheep have died of rot, and a great many fowls of cholera. The following is regarded as a fair estimate of the value of the losses for the year: Horses, \$800; cattle, \$7,500; hogs, \$7,500; sheep, \$2,250; and fowls, \$500.

Harrison.—But few losses have occurred from disease among the farm animals of this county the current year.

Jackson.—Farm animals of all kinds are looking well. No contagious or infectious disease has existed among them the past year.

McDowell.—Our farm animals have escaped all fatal diseases during the past two years. Hog cholera appeared in some localities in the adjoining county of Buchanan in the early part of the fall, but the area of infection has not enlarged.

Marshall.—There have been no losses from disease among any class of farm stock in this county which could be reliably estimated. Some cases of distemper have been reported among horses, but there have been few deaths.

Mason.—No contagious or epidemic disease has visited any class of our domestic animals this year.

Mercer.—No disease of a virulent type has prevailed among our horses, though an animal occasionally dies of distemper. Cattle have been affected with murrain, hogs with cholera, and sheep with rot.

Mineral.—All classes of our farm animals are exceptionally free from disease of every kind. A few cases of cholera have occurred among hogs and fowls during the year.

Monroe.—The loss of hogs in a portion of this county has been considerable. The disease is similar to scarlet fever, with more or less throat trouble. Some parties have lost all, while others have saved a few animals. Those that recover continue poor and worthless. The disease is variously pronounced scarlet fever, diphtheria, and a new kind of cholera.

Morgan.—The only disease that has prevailed among any class of farm animals has been among hogs. Fowls have suffered to some extent with the usual maladies.

Monongalia.—Horses are frequently attacked with distemper, but animals rarely die of the disease. Cattle are subject to black-leg, which usually proves fatal. Sheep die of rot, and fowls of gapes and cholera.

Nicholas.—Horses are occasionally afflicted with a mild type of distemper. Cholera has destroyed a great many hogs, but I have no means of ascertaining the number or value. Sheep have the rot, but that disease don't amount to much.

Pleasants.—There have been no contagious or epidemic diseases among our farm animals. Some losses have occurred among sheep and fowls, but it is very difficult to value the loss.

Preston.—Sixty-three horses died in this county during the year of pneumonia, and 27 of other diseases. A few cattle died of murrain, and some hogs of the usual diseases. Grub in the head is the only thing that has afflicted sheep.

Raleigh.—Hog cholera is the only disease of a contagious character prevalent among farm stock in this county. It has been quite destructive.

Randolph.—We have had no widespread disease among any class of our domestic animals during the year. A few cases of black-leg have occurred among cattle.

Ritchie.—Stock is in unusually good condition and entirely free from disease.

Roane.—A few hogs and quite a large number of sheep have died during the year of diseases incident to these animals.

Summers.—The only losses of consequence among farm animals have occurred among hogs. I think I can safely estimate that 40 per cent. of the total number in the county have died during the year. The disease is similar to swine plague as de-

scribed in your Department report. The lungs were much discolored; there was swelling under the jaws; weakness in the hinder parts, so that when they attempted to get up they would fall backward. Many persons lost every hog they had.

Tyler.—Occasionally our best and most promising yearling calves are attacked and die of the disease known as black-leg. At least 90 per cent. of those attacked by this disease die.

Upshur.—Pink-eye has proved fatal to some horses in this county during the year. Black-leg has been very destructive to young cattle.

Webster.—No epidemic diseases have prevailed among any class of our domestic animals this year.

Wetzel.—I find it impossible to procure the statistics you desire.

Wyoming.—Hogs have suffered with cholera during the summer and fall months. The disease has proved quite fatal. No treatment seemed to be of any service.

WISCONSIN.

Adams.—I have but a limited knowledge of the number of farm animals in this county, and have not the statistics at hand to answer your circular letter intelligently. There are but few diseases among any class, and I do not think that over 1 per cent. of the whole number die of disease.

Barron.—There are no special diseases prevailing at this time among our farm animals, nor have there been during the past year.

Brown.—All classes of domestic animals in this county have remained exempt from infectious and contagious diseases this year.

Buffalo.—The losses among farm animals in this county caused by disease have been exceedingly light the past year. Nothing like an epidemic has prevailed among any class.

Calumet.—No fatal disease has visited any of our farm animals during the past ten years; hence I have no report to make of losses.

Chippewa.—Some lung diseases have prevailed among horses, but the losses have been very light. Farm animals generally are in good health.

Dane.—No diseases of any kind prevail among the domestic animals of this county.

Dodge.—Pink-eye has prevailed among horses, but it has rarely proved fatal. A case of supposed glanders occurred early in the year. Two valuable horses were attacked, one of which was killed. Before the other one was killed another veterinarian decided that the disease was not glanders, and took the horse in hand and soon cured him. There has been no disease among other classes of animals.

Dorr.—No diseases of a fatal character have recently visited any class of our domestic animals. A few fowls died with the cholera during the summer months.

Douglas.—There is no disease prevailing among our farm animals, nor has there been the past year. Our fowls, when properly cared for, are remarkably healthy.

Dunn.—All our farm animals are exceptionally healthy. With the exception of horses which die from neglect, old age, &c., the losses are so few that they are hardly worth mentioning.

Eau Claire.—No infectious or contagious diseases have prevailed among our farm stock or fowls during the year.

Fond du Lac.—I find it impossible to give the information requested in your circular letter.

Green Lake.—There has been no prevailing disease among farm animals in this county during the past year—not that all animals are in perfect health, but there are no diseases except such as result from lack of care and other common causes.

Jefferson.—There have been no contagious or epidemic diseases prevalent among farm stock in this county during the past year. The mortality has, therefore, been no greater than could be looked for among healthy stock.

Juneau.—Hogs valued at \$2,000 have been lost by disease in this county the past year. A great many fowls have also died of the various diseases incident to them.

Kenosha.—No fatal diseases have been reported as prevailing among farm animals in this county the past year.

Kewaunee.—No losses worthy of record have occurred among any class of our farm stock during the past year.

La Fayette.—No epidemic disease has prevailed during the year among horses, cattle, hogs, or sheep. Fowls are suffering with cholera to some extent; perhaps 2 per cent. have been affected.

Marquette.—Some few horses and cattle have died during the year, but hogs and sheep have remained healthy.

Pierce.—A great many horses have been attacked by distemper, and several cases have proved fatal. Pink-eye prevailed quite extensively among these animals last year.

Polk.—The past year has been one of more than usual health among all classes of farm animals in this county.

Racine.—Farm animals generally have done well the past year. I have no means of ascertaining the value of the losses.

Richland.—I hear of the prevalence of no diseases among stock except pink-eye in horses. A great many of these animals are blind or nearly so. The disease is not often fatal.

Sauk.—The diseases of horses are mostly caused by overwork. Hogs in one locality have been afflicted to some extent, but the losses have not been very great.

Sheboygan.—No epidemic of any kind has appeared among our domestic animals the past year. That our county is so exceptionally free from all animal plagues is in a great measure owing to the stringent regulations of our county dairy association.

Trempealeau.—The only contagious disease that has prevailed among any class of live stock the past year has been horse distemper. There have been some losses from this disease.

Vernon.—Horses have been afflicted with distemper, and cattle with heart disease, or dry murrain, and black-leg. Swine plague has prevailed quite extensively, grub in the head has caused the death of a great many sheep, and cholera has prevailed to some extent among fowls.

Waukesha.—All kinds of farm animals are in excellent health. No unusual or epidemic disease has visited them during the year.

THE TERRITORIES.

ARIZONA.

Apache.—Aside from cattle and sheep there are but few farm animals in this county. There are 12,000 of the former and 300,000 of the latter. The county is better adapted to sheep raising than anything else. Both cattle and sheep are in good health.

Yavapai.—No contagious diseases have visited any class of farm animals in this county the past year.

DAKOTA.

Aurora.—This county has been organized but thirty months, and the few farm animals we have were brought in from the States. All classes have been very healthy. It is reported that in the extreme southwestern part of the county a peculiar disease has attacked the horses, causing the death of two or three animals. The symptoms are similar to an attack of hiccough.

Bon Homme.—I have no losses of consequence to report as having occurred from disease among our farm animals for the past year.

Brulé.—A good many horses died in this county during the year, but none with infectious or contagious diseases. Hard work, no stables, long drives, poor care, and in some cases poor water, all combined made the fatality serious. Black-leg or an-

thrax prevailed to some extent among cattle in the southwestern portion of the county. The disease was quite fatal.

Cass.—The farm animals of this county have remained exempt from all infections and contagious diseases during the year.

Clay.—No epidemic diseases have prevailed among our farm animals during the past year. An occasional death has occurred, but always from natural or accidental causes.

Codington.—All classes of domestic animals, with the exception of horses, have remained healthy throughout the year. A correspondent at Watertown reports glanders as prevalent in his part of the county. He says there are probably 50 horses affected with the disease at this time. It proves fatal in almost every case.

Charles Mix.—Horses have been healthy. A disease has prevailed among mules which has proved fatal in almost every instance. The disease is called meningitis, but nobody really seems to know anything about it. Some spring calves and a few yearlings have been lost by a disease known as black-leg.

Deuel.—Horses, sheep, cattle, and hogs, where well taken care of, have been exceptionally healthy. Our feeding places are high and dry, and conducive to health.

Faulk.—This county was only organized about one month ago, therefore we have no statistics as to numbers of animals or value of losses. I have heard of no fatal diseases among any class.

Grant.—It may seem like a strange report, to say that there have been no losses among farm stock in this county during the year, but such is literally the fact. The county is new, and the stock young, vigorous, and healthy.

Hamlin.—The only losses that have occurred during the year among our farm animals have been among horses and sheep. These losses have been quite light, and were not caused by any epidemic disease.

Hand.—We have but a small number of domestic animals in this county. No unusual disease has prevailed among either class or among fowls the current year.

Hutchinson.—There has been no general disease among domestic animals during the year. Cases of sickness are generally brought on by exposure or neglect. Three or four cases of so called black-leg that I investigated appeared to be inflammation of the lungs. Farmers are abandoning sheep raising.

McCook.—A great many horses have been affected with a dropsical disease, which seems to have proved fatal in some cases. Black quarter has affected the cattle to a considerable extent. It has been mostly confined to calves, yearlings, and two-year-olds.

Minnehaha.—A few cattle have been affected with the big jaw, or swelling of the jaw and throat. Our heaviest losses among cattle have occurred from black-leg.

Morton.—The only disease of a contagious character among any class of farm animals is that known as scab among sheep. It prevails only in one flock—a drove of 2,000 head, brought from Minnesota in October.

Sanborn.—No losses are reported as having occurred among the domestic animals of this county during the year.

Spink.—I have no facilities for procuring the information asked for by your circular letter.

Stutsman.—This county has been but recently organized, and we have but a limited number of farm animals as yet. There are no contagious diseases prevalent. Exposure to inclement weather caused the death of about 5 per cent. of the sheep of the county, last winter.

Turner.—Some pink-eye has prevailed among horses, but no deaths have resulted. Other classes of animals are healthy.

Walsh.—No diseases worth mentioning are prevalent among any kinds of live stock.

Yankton.—I estimate the value of the farm animals and fowls lost in this county the past year as follows: Horses, \$12,000; cattle, \$8,400; hogs, \$3,000; sheep, \$150 and fowls, \$216.

MONTANA.

Gallatin.—There have been some deaths among horses caused by distemper and pneumonia. There has been some scab among sheep, but the losses have been light. Hog diseases are not known here.

Lewis and Clarke.—All classes of domestic animals are healthy and free from destructive diseases.

NEW MEXICO.

Grant.—In May last a disease supposed to be black-leg broke out among calves in this county, and carried off all attacked. In September Texas fever was brought into the county by a herd of Texan cattle. Fully 500 head of cattle were destroyed by the disease. During the summer months cholera destroyed a large number of fowls.

Santa Fé.—I find it impossible to furnish the information desired by the Department.

San Miguel.—A number of horses have been poisoned and died from eating the loco weed. We have 100,000 head of cattle and 500,000 head of sheep in the county. I do not think the annual losses among these animals from all causes will exceed 2 per cent. A great many of these animals have died from eating the poisonous loco weed. In some localities this weed does not seem to affect stock.

UTAH.

Box Elder.—No destructive diseases among our farm animals this year. Last year 50 horses died of the disease known as pink-eye, and 150 head of yearlings of horned cattle died of black-leg.

Davis.—I have no means of ascertaining the number of farm animals in this county. I have heard of no diseases prevailing among them.

Salt Lake.—A few horses have died during the year of disease. This is a very healthful county for stock, and if the animals were properly protected and cared for the losses would be nominal. Scab is the only disease that troubles sheep. Putrid fever has prevailed to some extent among cattle on the ranges.

Millard.—This is a very good climate for stock, and the mortality is never very great among any class from epidemic diseases.

Morgan.—Horses and horned cattle do remarkably well in this county, and are rarely visited by epidemic diseases. Cholera and black teeth are the prevailing diseases among hogs. There is some scab among sheep and the usual diseases among fowls.

Tooele.—The value of the losses among all classes of farm animals in this county from disease the past year will not exceed \$2,000.

WASHINGTON.

Asotin.—We have the disease known as pink-eye among horses. It seems to be quite variable in its fatality—to depend, to a considerable extent, upon the range. Some cases of black-leg have occurred among young cattle, with invariably fatal results. This is a new county, formed from a portion of Garfield and Columbia counties.

Callohan.—Our farm animals are in good health, and I have no losses to report from disease for the current year.

Garfield.—Pink-eye prevails among horses, but generally in a mild form. Rest and turning out to grass has been found the most successful treatment. Black-leg prevails among cattle, but is generally confined to young stock. Hogs are never diseased in this locality.

Island.—There has been no epidemic among farm animals here. Fowls, however, are frequently troubled with a disease that causes the death of numbers of them,

both at maturity and while young. Early spring turkeys have a stiffening of the joints of the legs that soon causes death. It is apparently a kind of rheumatism. Those hatched late escape the trouble. I have been hatching by artificial means the past season. As a result, I find a chicken's future is determined by its first three weeks of care.

San Juan.—There have been twelve fatal cases of black-leg among calves in this locality. Bleeding in the early stages of the disease has been found beneficial. A few fowls have been lost, but with no marked disease.

Spokane.—Horses in this county are frequently affected with glanders, distemper, and other nasal diseases. Black-foot is the only disease that ever attacks our cattle. Diseases among swine are not known.

Thurston.—I have no losses to report among farm animals or fowls for the past year. All seem to be healthy and in fine order.

Wahkiakum.—I am glad to be able to say that no diseases of any kind prevail among our farm animals, consequently I have no losses to report.

Whatcom.—No diseases of a fatal character have prevailed among any class of our domestic animals for some years past.

Whitman.—Some few cases of anemia and pink-eye have occurred among horses, but not more than 5 per cent. of those attacked have died. No other class of stock has suffered with disease.

WYOMING.

Albany.—No disease of consequence has prevailed among horses or cattle this year. Sheep have been afflicted with scab. Animals valued at \$1,125 have been lost by this disease.

Johnson.—The prevalent disease among our horses is called pink-eye, which occasionally proves fatal. This is a grazing county, and contains some 200,000 head of cattle of all ages. A few of these animals have been affected with swollen jaw. As a general thing they have been healthy, and the value of the losses will not exceed \$5,000 for the year. Scab has prevailed in sheep, but the losses have been light.

Uintah.—There has been no epidemic or fatal disease among farm animals in this county for some years past. Scab in sheep occasionally causes a small loss.

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